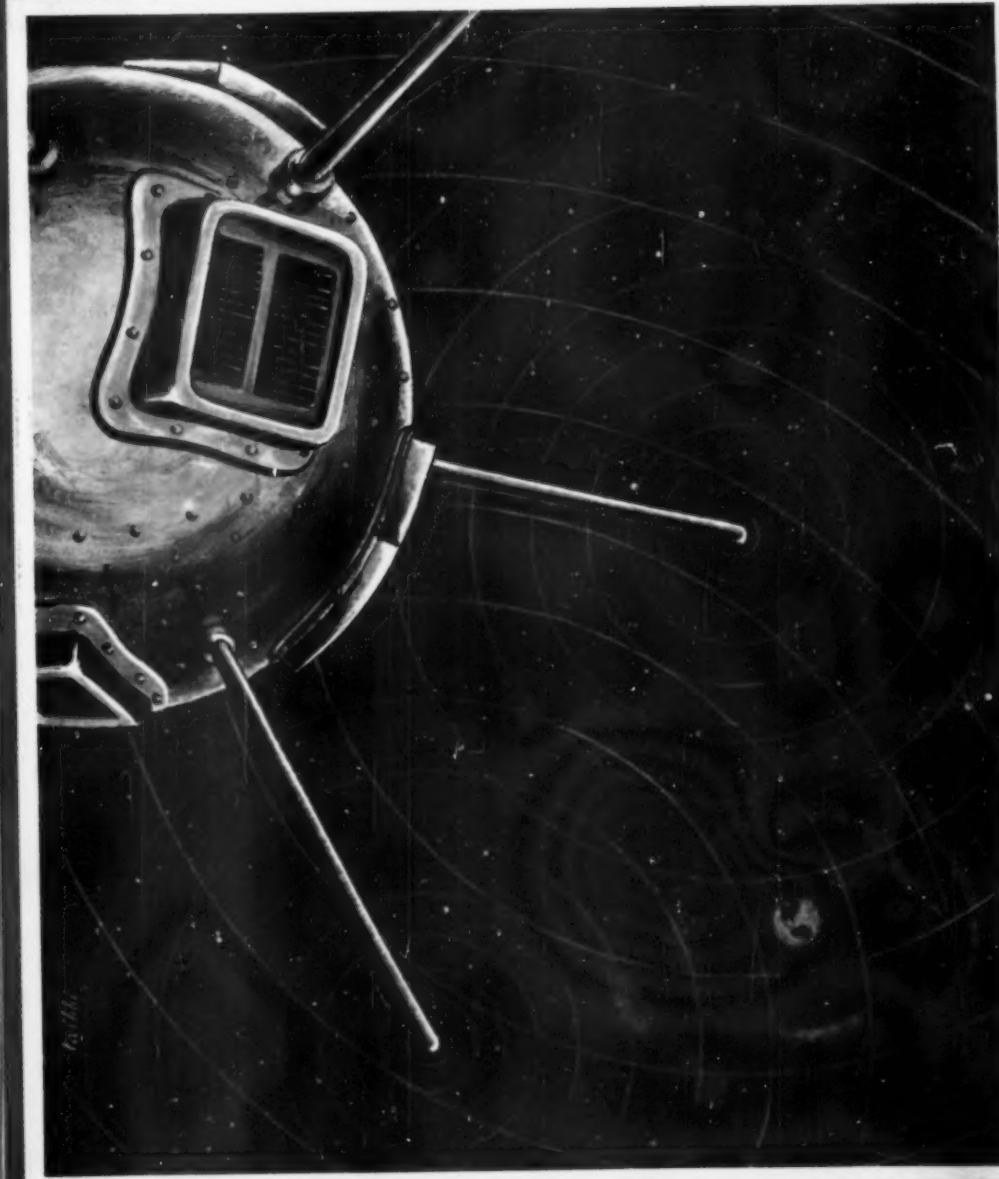
Bell Telephone MAGAZINE

SPRING 1958



Vanguard satellite communicating in orbit

VOLUME XXXVII NUMBER ONE SPRING 1958

Bell Telephone Magazine

A non-technical review, published quarterly to give Bell System management people a broader view of the history, objectives, operations, and achievements of this business than they might attain in the course of their day-to-day occupations, and an added sense of participation in the problems and accomplishments of our nation-wide public service.

COVER: "Vanguard Satellite in Orbit." Painted for this MAGAZINE by *Salvatore J. Taibbi*

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A MEDIUM OF SUGGESTION and A RECORD OF PROGRESS

JUDSON S. BRADLEY, *Editor* SALVATORE J. TAIBBI, *Art Editor*

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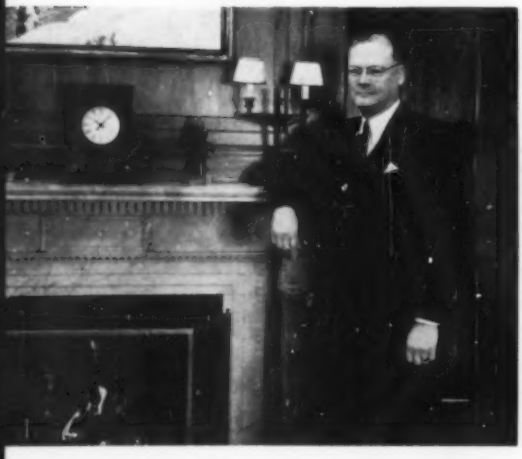
FREDERICK R. KAPPEL, *President* S. WHITNEY LANDON, *Secretary* JOHN J. SCANLON, *Treasurer*

Who's Who & What's What In This Issue

FREDERICK R. KAPPEL was elected president of the American Telephone and Telegraph Company on September 19, 1956. He had been president of the Western Electric Company, the manufacturing unit of the Bell System, since January 1, 1954. Mr. Kappel started in the plant department of the Northwestern Bell Telephone Company in 1924. In the next few years he held many assignments in the plant, engineering, and commercial departments—all in Minneapolis. Ten years after he had joined the Bell System, he went to Omaha as plant engineer of the Nebraska-South Dakota Area, and three years later he was plant operations supervisor on the staff of Northwestern Bell at Omaha. In 1939 he became assistant vice president of operations, and after three years he was elected vice president of operations and a director of the Northwestern Bell Telephone Company. He came to A. T. & T. in January,

Frederick R. Kappel



C. C. Duncan, left, aboard H.M.T.S. Monarch, *at the time of the laying of the transatlantic cable. Beside him stands Frederick R. Kappel, then president of Western Electric; Messrs. W. A. Wolveson and R. J. Halsey of the British Post Office; and, at the far right, Cleo F. Craig, then president of A. T. & T.*

1949, as assistant vice president in the Department of Operation and Engineering. In February of that year Mr. Kappel was elected vice president of the Long Lines Department. In November, 1949, he returned to the General Departments as vice president in charge of Operation and Engineering. He remained in this post until he became president of Western Electric. Mr. Kappel's "Common Goals for Changing Times" appeared in our issue of Autumn 1957, and his "Business Needs Basic Research" in the last issue.

SAVE FOR an interval of eight months in 1951 when he was supply practices engi-

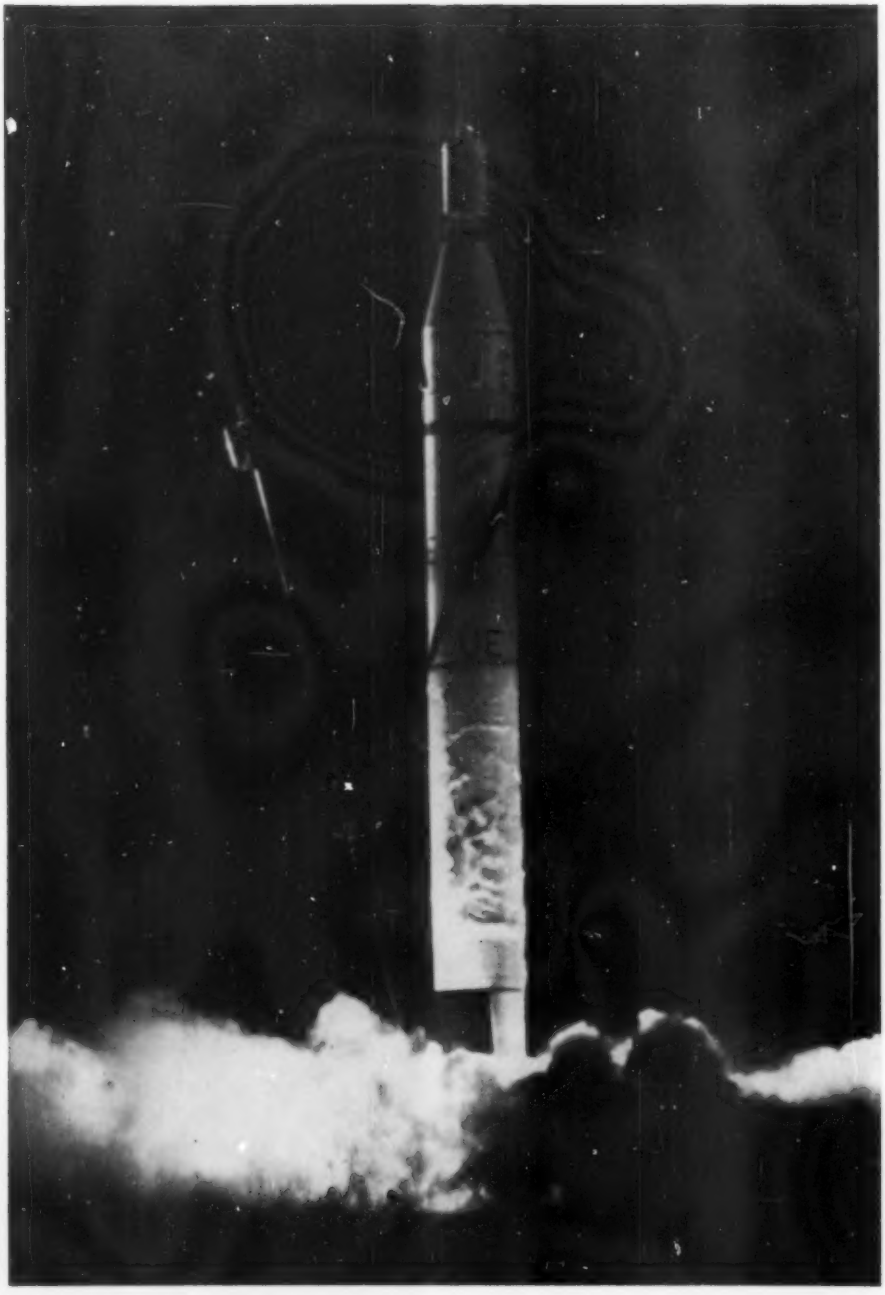
Thomas D. Nicholson with the Zeiss projector of the Hayden Planetarium

neer in A. T. & T.'s Department of Operation and Engineering, C. C. DUNCAN has spent his 31 Bell System years in the Long Lines Department. He joined it in St. Louis as a student in 1927, became a technical employee, and in 1937 was appointed district Plant engineer. He went to Dallas as district Plant superintendent in 1939 and stayed there seven years, returning to St. Louis to become division construction co-ordinator and division Plant superintendent. In 1950 he was transferred to Long Lines Headquarters in New York as general Plant supervisor. Later that same year he was appointed Assistant to the General Manager, where one of his principal responsibilities was the direction and coördination of Long Lines Plant protection and defense activities. After his return from A. T. & T., he was made Operating Staff Manager. In 1953 he became General Manager-Special Projects—an appointment which made him responsible for the engineering aspects of the Atlantic, Alaskan, and Hawaiian submarine telephone cable projects. Since 1956 Mr. Duncan has been Assistant Director of Operations in charge of the Long Lines Headquarters engineering staff. He is an associate of the A. I. E. E. and of the Armed Forces Communications Association. He has recently returned from a trip to Anchorage, Juneau, Annette Island, and Ketchikan, Alaska, in connection with the official opening of the White Alice communication system, with which he had been concerned. This is an integrated system for military and civilian use, which employs both microwave radio and the recently developed over-the-horizon method in providing a high-quality, reliable service under extremely rugged weather conditions. Mr. Duncan contributed "Conservation of Materials" to this MAGAZINE for Autumn 1951, and "Transatlantic Cable Puts Out to Sea" to the issue of Summer 1955.

THE CLOSE RELATIONSHIP between celestial navigation and astronomy is demonstrated once again by THOMAS D. NICHOLSON,

(Continued on page 59)

F. Hobart Walker



"... four ... three ... two ... one ... fire!" Missile taking off from the launching pad at Cape Canaveral. See the article beginning on page 25

A condensation of six articles which the Christian Science Monitor *asked the head of the A. T. & T. Co. to write for publication last January.*

DESIGN FOR SERVICE IN A GROWING NATION

FREDERICK R. KAPPEL

President, AMERICAN TELEPHONE AND TELEGRAPH COMPANY

WHEN I ASK PEOPLE outside of our business what they think the goals of the telephone company ought to be, they make practical, down-to-earth answers. Give us good service – they say – at reasonable prices. Be human and considerate in your dealings. Play fair with employees and share owners and bondholders. Look ahead: be progressive. Don't ever be complacent or self-satisfied.

These are plain, uncomplicated ideas. They are also pretty far-reaching. To my mind, the success of the Bell Telephone System will mostly depend on how well we live by such ideas, and also on how well the public understands that this is what we are trying to do.

A very big business

OURS IS PLAINLY a very big business. In fact, in dollars invested, abundance of physical plant, number of employees, and number of owners, it is the biggest business of all by a considerable margin.

But what do we sell? Not "big" equipment. Not 10-ton trucks or bridge girders or even carload lots of nuts and bolts. We sell telephone service to individuals and we sell it one call at a time. (We also provide networks of private communication lines for other business and for government, and long distance pathways interconnecting TV and radio stations. But these and other special services come to only four per cent of all our business.) The great bulk of our work is in handling one conversation after another, and most of these are local within the community calling area.

So, big as we are, at the same time we are a local retail business in each community. No distributor or middleman comes between us and our customers. We must live in the midst of each city or village we serve, and know and heed the interests and wants of local people. We are a big business, in short, which must be a small business too in every home-town we serve. When I say "be," I mean just that; this is not something that can be accomplished by make-believe.

What, then, are the values of our big-

Telephone people work for the community off the job as well as on—for instance, as Boy Scout leaders

ness? I think there are several, and that each is tremendously important. Just as our need to be small in each community grows out of the nature of our service, so too does our need to be big.

A telephone is useless by itself. Its value is in reaching other people. The more telephones are interconnected, the greater the value. If everyone in town has phone service, that affords everyone more convenience than if half the people have it and half do not. And the value increases further when you can call anywhere you want—across the continent as well as across the street. So all the millions of telephone instruments, and the vast network of lines, and the thousands of switching offices, mean that we can give more value to each customer. In fact, this very size and abundance are really indispensable to a complete and fully satisfying service.

Moreover, all parts of the network must work well together. For all its size and sturdiness, a telephone system needs to be very precisely and delicately balanced. For instance, when you call Texas from Boston, many devices along the way continuously regulate the quality of the talking path—even compensating for differences in temperature. This is a simple illustration of how unified operation helps to achieve good service. And such service results not only from the coördination of equipment, but, more basically, from the coördination of human effort. Without both, good and dependable service would hardly be possible.

There are many other telephone companies which connect with the Bell System. It takes no credit from any of them to point out that a unifying, nationwide network increases the value of their ser-

ice too, just as their interconnection with us increases the value of ours. And to a marked degree, the teamwork between Bell and non-Bell companies extends the coördination on which all good service depends. This I think only emphasizes further the inherent advantage of the Bell System's own set-up.

Big research has big results

TELEPHONE SERVICE is based on scientific discovery. It is the fruit of basic research that has brought much new knowledge, and of thousands of inventions. These inventions have then had to be organized into systems. All of this takes a massive coördinated research and development effort, and requires a great deal of money. Without this big-scale effort, telephone progress as we have seen it could never have come about.

One man, Alexander Graham Bell, invented the telephone. This was one of the great inventions of all time. But it was a beginning, not an end. Today some 10,000 people, including more than 3,000 scientists and engineers, work in Bell Telephone Laboratories. Many in the group work on defense projects for the Government, but the main emphasis is on improving telephony.

Big research has already brought many big results. It is this that has brought about long distance services; local and long distance dialing systems; transistors; coaxial cable and radio relay systems which can carry TV programs as well as thousands of telephone conversations simultaneously over the same route.

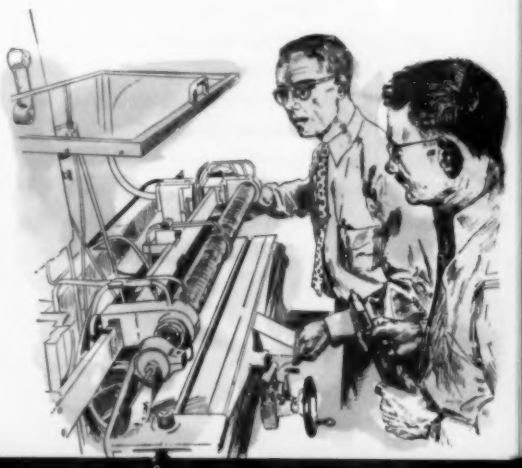
It is this also that has enabled us to bring and keep the price of telephone service within the reach of millions. A telephone system is not like a water or electric power system, which can use the same line to serve additional customers. Whenever we serve a new customer, *we must also provide additional facilities so that everyone else can reach him.* So there is an inherent tendency for costs to go up as the telephone system grows. To combat this, Bell System research has continuously produced more efficient equipment, and our success in this respect goes to the very heart of telephone progress. I conclude, therefore, that large-scale research by the Bell System is not merely an advantage. It is a necessity.

Perhaps it hardly needs to be said that projects big in design also have to be big in execution. The first transatlantic cable, for instance, cost nearly $40 million, and the cable to Hawaii about the same.

To give another example, we now have in operation about 50 long distance switching systems in as many different cities to handle long distance calls which are dialed by operators and telephone users. These are key units, so to speak, in the over-all arrangements we are now making to enable all our customers to dial anywhere. Investment in these 50 units is already in the hundreds of millions of dollars, and there are more still to be built.

The meaning I think is clear. If we are to have the better, faster, and more convenient service that systems like these per-

Bell Laboratories research produced the "zone refining" process for making super-pure germanium, used to make transistors



mit, we need organization on the scale that can plan and coördinate them; research on the scale that can bring them into being; and investment (with earnings to support it) on the scale that can pay for them and put them in the public service.

The Western Electric Company—manufacturing and supply unit

In the Bell System, manufacture, like research, is embedded in the service organization. Thus we get three-way teamwork, and this to my mind is the key to success in serving the public. Western Electric people are just as devoted to the goal of giving service as their associates in the telephone companies. There is no dividing line, no divergence of interest, no motive at odds with the service motive. All work to the same end, and more closely than they could possibly do otherwise.

What is the practical result?

We continuously compare Western Electric equipment with that made by others. By every available test, the equipment is superior and the price is less. No doubt Western's being the largest producer is an important factor in reducing its costs. Western Electric earnings over the last five years have averaged 3½% of sales. That these earnings are moderate, to say the least, every other manufacturer well knows.

Western Electric never spares the horses to meet a Bell System need. Here are three illustrations:

1. In emergencies—fire, flood, hurricane, earthquake—telephone operating people know that Western will work around the clock to rush materials. (Incidentally, experience in disasters shows in several ways the value of a unified telephone organization. Repair forces from all points of the compass go to the disaster area. Western hurries along the supplies from strategically located distributing centers. Since the equipment and methods used by all companies of the System are the same, everybody is familiar with them and work proceeds quickly.)

2. Western produces in great volume what the Bell System needs in great volume. But the physical plant of the System is constantly changing. There are always small needs for replacement parts in equipment due to be changed in the future, but which in the meantime must be kept in perfect order. Western Electric has specially organized to meet these needs and makes thousands of items in small numbers, in addition to the things it makes in large numbers. This makes it possible to "evolutionize" Bell System plant in the most efficient way.

3. With the end of World War II the public's demand for telephone service soared to unprecedented heights. Western Electric instantly took every risk involved in doubling its investment in production facilities in a few years' time. For another manufacturer to have taken comparable risks at the Bell System's request is inconceivable. But for Western Electric there was no question—because it is part of the telephone team, and service is the goal.

One other aspect of having a big and unified telephone organization needs mention. Communications are the first line of defense. The telephone system has a tremendous responsibility, which is shared by Bell and non-Bell companies alike. There is a great deal for all of us to do and we work closely together to meet all military and civil defense needs. But I think everyone feels that the task is greatly facilitated by the existence of a big organization through which a large share of the work can be coördinated.

Just as one example, the Bell System has been building a great many so-called "ex-

press" telephone routes which by-pass or go around centers that are potential targets for enemy attack. These we use for everyday service, but they are so planned that in event of disaster, emergency communications can be maintained.

Finally, the research and manufacturing skills of Bell Laboratories and Western Electric are of great value in designing and building communication and weapon systems for defense. We are asked to do a great deal of work on missile guidance systems. At the Atomic Eneregy Commission's request, we manage the Commission's Sandia Laboratory, which develops and designs atomic weapons. At the Air Force's request, we organized and carried out construction of the Distant Early Warning Line in the Arctic. We do not seek these assignments, but we do them willingly when the Government says that our combination of skills, and the way we are organized, uniquely fit us for the task. And when these requirements come to us, I reflect that if it is important to defense that there be an organization such as ours, it is equally so that the same combination continue to do its best toward the purpose for which it was originally intended—namely, to give the public an ever-improving telephone service.

To serve well } – { ***to prosper***

THE FUNCTION of the Bell System must be to serve the public and serve it well. But we can only serve by earning money—and enough to keep ourselves in good financial shape so that we can go ahead with research and keep on making service improvements.

The whole matter can be put in two very short sentences. They are: We must serve well to prosper. We must prosper to serve well.

A Western Electric employee connects wires to a telephone transmitter by means of a screwdriver operated by compressed air

This may sound elementary. And the reasons why the Bell companies have had to increase rates are elementary also. We have been plagued by inflation just like everyone else. Our costs have gone up and are still rising. Wage increases alone have about equalled all the increases in Bell telephone rates since before the war.

What is not so elementary is the question, "Just how much should a telephone company earn?" I am going to state my view in a way which may not have occurred to some. I think we should earn enough so that in the long run the cost of service to telephone users will be *lower* than if we earned *less*.

At first this may seem a bit of a paradox. But is it? Just consider: Only with good earnings can we conduct the business most efficiently. Only with ample resources can we push research in such a way that we will get better and more efficient equipment at the earliest possible moment. Only if we have enough money can we spend money in ways that will reduce the cost of service in the long run.

For instance, think of any community whose telephone needs are growing. A new central office that will meet those needs for a reasonable period ahead will cost more at the start than a smaller office that will only meet them for a very short time. But the smaller office will then have to be enlarged, and this will cost more in the end. If we are so scrimped from year to year that we have to build piecemeal, this is bound to increase the cost of service in the long run. But if we are financially able and free to do the right kind of job at the start, the average cost through the years will be less.

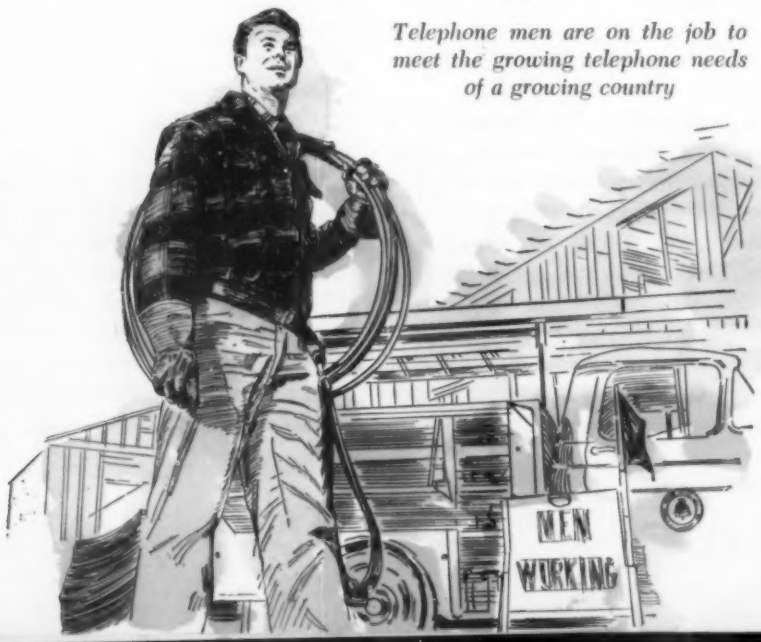
Under present conditions, I believe that earnings in the neighborhood of 8 per cent on the capital invested in the Bell System will give the best long-run assurance of excellent service at the lowest possible price. Such a return, incidentally, compares with average post-war earnings of more than 12 per cent by large manufacturing companies, with which the Bell System must compete for new capital. However, we believe our earnings need not be as high as theirs because the degree of risk in our business, while increasing, is not yet as great as in theirs.

Eight per cent is more than we earn today and more than most regulatory commissions have been willing to allow. If the principle I have set forth above is correct, why then have the commissions for the most part held telephone earnings down?

No doubt this is partly because many regulatory people have yet to be convinced that the thesis is sound. Moreover, the immediate cost of getting started is quite a hurdle to clear. If a low-earning company hasn't the money to invest in economies, it will have to have a rate increase to start the expenditures that will reduce costs. This means asking the public to pay now for future benefits.

And for the regulator the difficulty is compounded. For many years the habit of regulation has been more to apply restrictions than to take them away. There has grown up quite a body of belief that the way to keep rates low is to keep earnings low—even though this particular pudding has no proof. To depart from this dogma (I almost want to call it folklore) is not easy. To do it, the commissions must not only be convinced that the right course is to regulate up rather than down. They must also have the very considerable courage needed to take the political responsibility.

Telephone men are on the job to meet the growing telephone needs of a growing country



Yet I am sure that just such courage is needed to give this country the best and most economical service in years to come. We in the Bell System have studied this matter carefully. We know that electric and gas utilities which earn relatively well give as good or better service—*at lower rates* on the average—than those which earn poorly. We know our own Bell telephone rates are lower on the average in states where earnings are better than average. I don't cite these examples as scientific proof, but they do suggest the possibilities in a little less restriction, a little more freedom.

There is no law I know of that prevents reasonable freedom under regulation. There is none that requires regulation to be timid or slow, or to put its reliance in technicalities. And I want to say that the Bell System is in no way opposed to regulation. We are not merely not opposed to it, we are for it—and this is no lip-service. A business like ours, which doesn't have competition in the same degree as many others, has to be regulated. But this doesn't make us different from other people. We react to incentives and opportunity just as they do. We too need good earnings and ample resources to put in improvements and economies. We too need freedom—under regulation—to do our very best.

An up-from-the-ranks business

Of course, good service can only be rendered by people who sincerely want to meet the needs of others. To feel that way about their jobs, they must also feel that their own needs are being considered. Let me list briefly some of the things we think are most important to the success of our human effort. Underlying all of these must be the understanding that every employee is important as an individual and needs a

Every day, in thousands of neighborhoods around the nation, the telephone splicer plies his craft

work environment which gives opportunities for personal growth.

First is to pay good wages. We need able people and should pay them accordingly. On the other hand, to pay more than similar abilities command elsewhere in the community would seem to give telephone people a special privilege at our customers' expense. We think, therefore, that we ought to keep telephone wages well up in the "good pay" range, but not out in front of everybody else.

Second, employees want the chance to get ahead. This is essential to a good working climate and getting a good job done. So we must not only provide opportunity, but also help people prepare themselves for it.

On the side of providing opportunity there are several practical needs, in addition to the basic requirement of keeping the business progressive and financially healthy. For example, there has to be a just and orderly plan for the retirement of older people. The Bell companies have had pension retirement plans (paid for entirely by the companies) since 1913, with pensions directly related to wages and years

A long distance switchboard. Bell telephones are 92% dial, yet there are more than twice as many operators today than when dial telephones were installed in 1920

of service. Today the social importance of pension systems is generally recognized, but I want to point out again that in a business like ours, having an orderly retirement procedure makes a tremendous contribution to good service, for it keeps the way open for promotion and continually provides incentives to younger people.

As a matter of interest, with the growth of the telephone business and the operation of our pension plan, since 1950—on the average—there have been 13 promotions each year for every 100 Bell System employees.

Another big factor in providing opportunity is to spread authority as much as possible. Maybe some people still have the idea that a few top managers in a big business run the whole show, and everyone else does what he is told. The truth is we couldn't conduct the Bell System that way even if we wanted to, and we don't want to. Good service begins in each local community, and it is simply impossible for faraway higher-ups to know all the whys and wherefores of local needs and act effectively to meet them. Responsibility and authority *must* be decentralized, and the more the better.

Decentralizing not only provides opportunity, but helps people prepare themselves for more of it. I think it is well-known that the Bell System is an up-from-the-ranks business. No large share-owning interest dominates the management or says who the top managers shall be. They have to come up the ladder step by step. So it is vitally important that we push out responsibility and authority as much as we can, and give able people the kind of training that comes from having to make decisions and live with them.

Yet this is not a matter of pushing people off the dock to see if they can swim. To help men and women prepare themselves for opportunity, we must train them in specific skills. We must also, I feel sure, tell them freely and frankly about the progress of the business, answer their questions without quibbling, and generally do everything we can to bring about good communications and understanding up and down the line of organization.

Beyond this, we see a real need for, and are widely using, organized study, conference, and discussion. These programs are aimed at helping members of management to grow in skill and stature *as managers*; to test their thinking when confronted by other points of view; to chew on tough problems of the sort they might have to face in new job assignments; to see their immediate jobs in relation to the success of the whole business; and to broaden their understanding of social and economic

forces and the place of the Bell System in the world we are trying to serve.

To make service even better and more useful

IF A BUSINESS isn't progressive and forward-looking, it doesn't take the public long to find it out. This is as true for us as for any other business. While we may not compete in quite the same way retail stores do, or makers of shoes or sealing-wax, we don't lack spurs to a better job. We compete with other forms of communications, and with transport systems, and also with all other industry for our share of what the public has available to spend.

This means, too, that we need to promote and sell. There is simply no basis for the old saw that "everybody has a phone, so you don't need to advertise." One of the main reasons for the growth of telephone service is the fact that we have promoted and sold it. Moreover, this is indispensable to a vigorous and progressive spirit among employees. They compete with each other, and the various Bell companies likewise compete with each other in every phase of the job.

I deeply believe that Americans have gained a great deal from the development of telephone service in the American way, as a free private enterprise under public regulation. It can be stated as a fact that most of the great advances in telephony have been made in this country. And they have been made rapidly. Few people today recall that when World War I began, it was not even possible to telephone across the United States. Today it is a matter of a minute or two (and more and more frequently, only a few seconds) and the cost is about one-tenth of what it used to be. Moreover the average cost of all telephone service (notwithstanding the increase in price since the end of World War II) is a smaller part of most household budgets than it was in the past.

I am confident that, given reasonable freedom and good earnings, the telephone companies in years to come will be able to do even more in the public interest. In the last ten years our technical progress has been greater than ever before. Already millions of people can dial long distance calls directly, in a few seconds' time. By 1965 this will be the general practice for most everyone. As a practical matter, the difference between local and long distance service is beginning to disappear.

In the research laboratories, entirely new all-electronic switching systems are now under development. These will start going into use in the 1960's, and in the next generation they will make possible many new and useful services. Likewise, new methods will be available for transmitting all kinds of information, including person-to-person television.

Progress of this sort gives people an increasing range of choice in communication service. Today this can be best illustrated

The spring cord which the service representative is demonstrating to the customer is just one of many postwar developments that add up to better telephone service

by the variety of telephone instruments and the many ways they can be arranged to suit personal convenience. For instance, we can offer telephones in color, telephones specially suited for kitchen or bedroom, button telephones for different office layouts, speakerphones that may be used without lifting the receiver, telephones particularly designed for noisy locations, and so on.

Here it may seem that I am getting down to details. But the idea behind all this is far from being a detail. People may (and frequently do) think of the telephone company as a monopoly. In the sense that we don't compete with other telephone companies in the same area, that is true. The public long ago decided that to have two companies competing in that fashion would be wasteful. But that still gives us no license for what you might call monopolistic behavior. Our license is simply to give the best possible service, and we think that definitely means giving our customers every practical option or choice to get what they want. This is the real drive behind the kind of thing I have been sketching out here.

At the same time, I want to say strongly that the Bell System does not intend to step outside its proper sphere of providing communications that serve the public interest. We have no wish to grow bigger merely for the sake of aggrandizement. Our job rather is to make our bigness—this vast network of lines and instruments and switching systems, which has no counterpart anywhere else in the world—to make this abundance more freely and easily useful to everyone; so that we can say to each telephone user in each community, "All this is at your service—and there will be more."

Many times, to make sure what a community's wishes are, telephone men and women have visited every customer in town

A Bell System executive discusses the responsibilities of the communications industry in national defense before the Industrial College of the Armed Forces

COMMUNICATIONS AND DEFENSE

C. C. DUNCAN

Assistant Director of Operations, LONG LINES DEPARTMENT, A. T. & T. CO.

(Note:—Mr. Duncan addressed the Industrial College of the Armed Forces in Washington, D. C., on March 3, 1958. His subject was "The role of the commercial telecommunication systems in preparedness for national emergency." *He spoke, by invitation, as a representative of the entire industry, which includes the international cable and radiotelegraph companies, the Western Union Telegraph Company, more than 4,000 independent telephone companies, and the Bell System. These organizations have assets of approximately 21 billion dollars, some two million owners of securities, and employ about 900,000 men and women—figures which emphasized to Mr. Duncan's military audience the industry's capacities both human and mechanical. The address is quoted in part below.* Editor)

THE NERVES of modern weapon systems are the electronic communications for collecting and disseminating information and for weapon guidance—integrated for effective military use by means of engineering, planning, and management. These arts are basic also to the communication business and it is, therefore, understandable why these companies are so heavily involved in defense.

All branches of the industry are or have been so engaged. Since I am more familiar with those being handled by the Bell System, I would like to discuss several of the defense projects in which it is involved.

Even before the start of World War II, the Bell System was called upon to take responsibility for many important undertakings of this nature because of its integration of basic research, design, development, manufacture, and operations. The System did not seek these assignments; in fact, its policy is to accept only those which it is particularly well qualified to handle. Nevertheless, the volume and variety of these assignments have steadily increased.

During World War II, approximately 85 per cent of the coördinated research, development, and production facilities of the Bell Telephone Laboratories and the Western Electric Company—the Bell System's manufacturing unit—were devoted to work for the Armed Forces. Again, starting in 1949 and greatly accelerating with the advent of the Korean outbreak in 1950, many of our facilities and personnel

The Industrial College of the Armed Forces was opened in 1924 as the Army Industrial College, and a class of nine officers was graduated in June of that year. The College was reconstituted in 1948 as a joint educational institution operating under the direction of the Joint Chiefs of Staff—its present status. Its objective may be said to be to enlarge the appreciation of its student body as to the importance of large segments of the nation's economy in promoting national defense. Its classes now total about 140, including not only officers from the Services but civilian members of major government departments.

The Industrial College of the Armed Forces moved in 1946 from the Pentagon to its own building at Fort Leslie J. McNair, a historic military site at the confluence of the Anacostia and Potomac Rivers, at Washington. The Post is also the home of the National War College, and the two institutions share some of the same facilities and coöperate to a considerable extent in lecture programs.

were taken from their normal duties and assigned to special defense projects . . .

EDITOR'S NOTE: *Mr. Duncan then proceeded to enumerate a number of important defense projects which have involved the Bell System—activities which in several instances have been described in this and other Bell System publications. These included the Sandia Laboratories, the DEW-Line, and the White Alice communication system. He then discussed a number of programs in the field of guided missiles:*

1. Nike—Anti-Aircraft Missile System—Ajax and Hercules

In 1945 the Bell Laboratories were asked to determine the feasibility of guided missiles for anti-air defense. By 1950 the design of such a system was almost completed when the Korean outbreak resulted in a military order to the Bell Laboratories and Western Electric to institute production on a "crash" basis, with research and development overlapping. Western Electric accepted over-all responsibility, utilizing subcontractor assistance to produce control systems for the missiles.

2. Missile Test Range Submarine Cable

The guided missile center at Cape Canaveral, Florida, and its firing range, extending over the Bahamas into the South Atlantic, has been prominently in the news lately. The Bell System built for the Air Force a submarine cable system over 1,000 miles long that connects the string of control stations extending from Cape Canaveral to Puerto Rico.

3. Titan

This most important project involves research and development by Bell Laboratories for a radio-inertial guidance system for the Air Force Intercontinental Ballistic Missile unit. Work has been under way for more than a year and the project is on schedule.

4. Nike Zeus (AICBM)—Defense Against Intercontinental Ballistic Missile

Faced with the threat of attack by ICBMs, the Army and the Air Force requested a Bell Laboratories-Western Electric study of the feasibility of defense measures, based on the evolving Nike family of guided missiles. Intensive study has shown defense to be feasible but very difficult and complex. Drawing on its Nike experience, both in development and production, a Bell System team is now heavily engaged in the AICBM program.

5. A Warning System for Ballistic Missiles

A system that will warn of a ballistic missile attack is vital to allow our defense commands to take off within their brief allotted alerts. Such a warning system is possible. It involves unusual radar installations in the very far north, their interconnection by communication links, and, most importantly, a sure and secure communication system to bring the warning instantly and reliably from these extreme

locations to Strategic Air Command Headquarters and its air bases. The Bell System team—composed of members of the operating telephone companies, Western Electric, and the Bell Telephone Laboratories—has been asked to plan for this communication system. It will connect with radar equipment to be installed under the direction of the Radio Corporation of America.

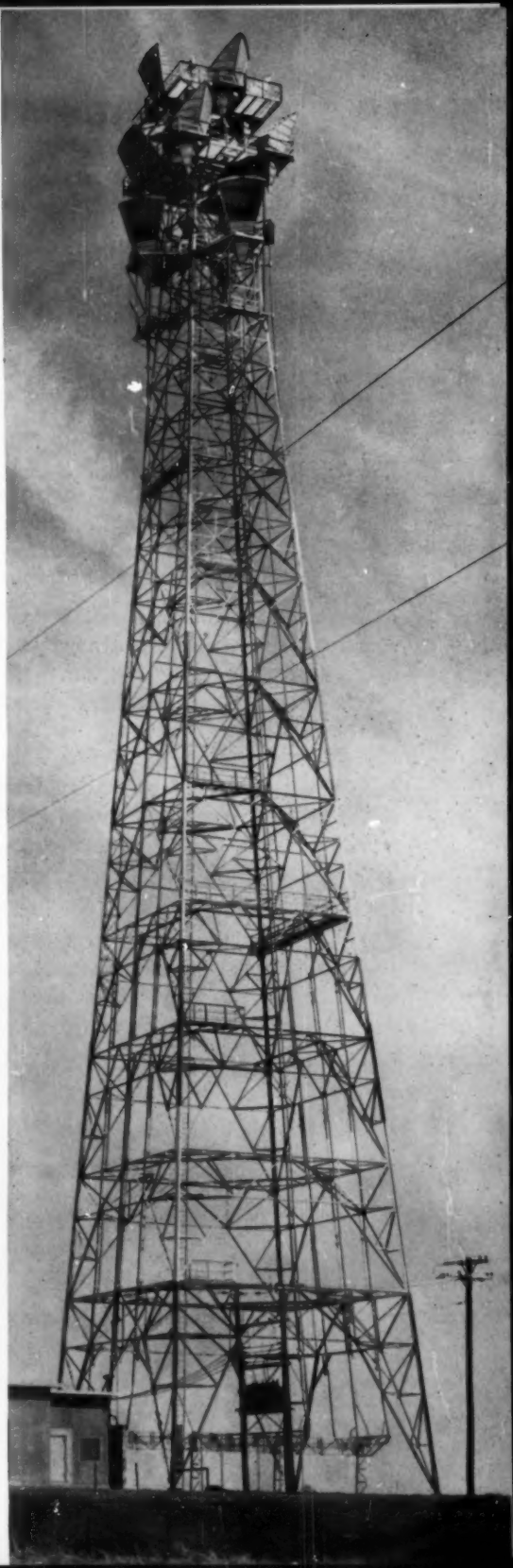
The American Method

IN ALL THESE PROJECTS, it has been the practice of the government to call upon the resources and know-how of the large communication companies to act as prime contractors in planning and supervising them. In turn, these organizations have asked the aid of thousands of sub-contractors to do much of the detailed engineering and practically all of the field construction work. Also, a large number of manufacturing companies have supplied the equipment needed. Here we have a partnership between big and little business.

Let me point out, incidentally, another significant fact about our communication industry. In its development and service, I believe I can say in all modesty, it is preeminent in the world. With us, the industry is almost all privately owned and operated. Abroad, for the most part, the communications organizations are government owned and operated. To me, the scope and excellence of our facilities are an eloquent testimony to the American method.

World-Wide Communications

IN THE YEARS since World War I, the communications industry, in coöperation with many overseas administrations, has provided a system of world-wide radiotelegraph and radiotelephone circuits. These



A busy radio relay tower on an important mid-West by-pass route, with ten antennas for transmitting and receiving

The Bell System made great contributions to the planning and construction of the White Alice communications system in Alaska, where it provides communications for military and civilian use

overseas circuits extend to almost every country, and were used extensively by the military forces during the last war.

While overseas radiotelephone circuits furnish good service most of the time, they have limitations. In your use of them, when telephoning abroad, you may have noticed fading and noise conditions that are sometimes experienced during magnetic storms. The effect of these storms varies considerably, with the worst conditions occurring

The Bell System built for the U. S. Air Force a 1000-mile submarine cable from the guided missile station at Cape Canaveral to Puerto Rico

across the North Atlantic and in the Alaska area. Another limitation in the use of radio is the crowding of the radio frequency spectrum. This has reached a point where it is difficult to add many more circuits to meet rapidly increasing civilian and defense needs. A third limitation, particularly important from the standpoint of defense, is the possibility of enemy jamming of this type of radio circuit.

Although these circuits have contributed greatly to world-wide communications and will continue to do so, it became evident a number of years ago that they would have to be supplemented by long submarine telephone cable systems. However, the problems inherent in transmitting the voice are quite different from those solved long years ago when underseas telegraph communication first became feasible. We in the Bell System have been working since 1919 on this problem of underseas voice transmission. As a result, a good submarine cable system was developed that uses underwater amplifiers, spaced about 40 miles apart, which can provide 36 telephone circuits over distances of about 2,000 miles. This development was completed shortly after World War II, and in 1950 a prototype of the system was installed between Key West and Havana.

In 1956, if you will recall, we constructed submarine telephone cable systems to Great Britain and Alaska, and last year one to Hawaii . . . Because of the success of the first transatlantic cable, we are now in the process of building a second system across the Atlantic. This one will extend to France and will serve the same European countries connected by the first cable as well as such additional countries as Spain and Italy. The second transatlantic telephone cable will be completed in 1959. By the use of these two cable systems and the existing radio channels, we feel that re-

liable telephone service can be furnished between North America and Europe at all times . . . Plans have also been announced for the construction of a submarine telephone cable system between continental United States and Puerto Rico, to be completed early in 1960.

Military Communications Circuits

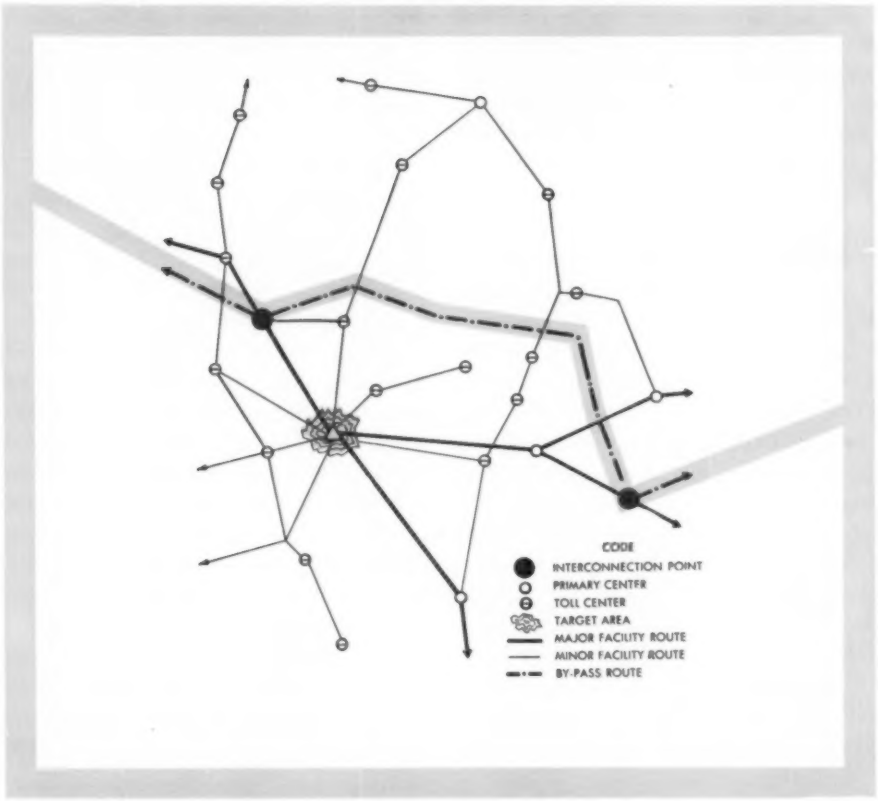
A NUMBER OF full-time networks involving millions of circuit miles connect military bases, government agencies, and civilian defense centers throughout the country. These circuits are in current use and are vital for directing the defense activities of the country in case of attack. The Air Force uses many of these circuits for the interconnection of radar stations, SAGE computer centers, fighter bases and command headquarters. Nation-wide air warning circuits and many others are being used, too. These facilities include those suitable for the transmission of data signals plotting the course of a plane, picture transmission, teletypewriter, television, and ordinary speech. In addition to these private line communication networks, all branches of the Defense Department use standard commercial service for individual calls.

Express and By-Pass Routes

EVER SINCE modern communications came into being in this country, the whole industry has been faced with the problems of providing uninterrupted service, despite storms and floods and even if a farmer should accidentally cut one of our cables in digging a ditch through his field. To be sure, much has been done to reduce the frequency of such troubles by improved engineering design and maintenance methods—but from time to time failures still occur. Long ago, we found the best way to provide reliable service was to diversify our circuits so well that all of our eggs were not in one basket.

With rapidly expanding volume and demand that require the construction of new telephone facilities, we have been able to provide this diversification by building new

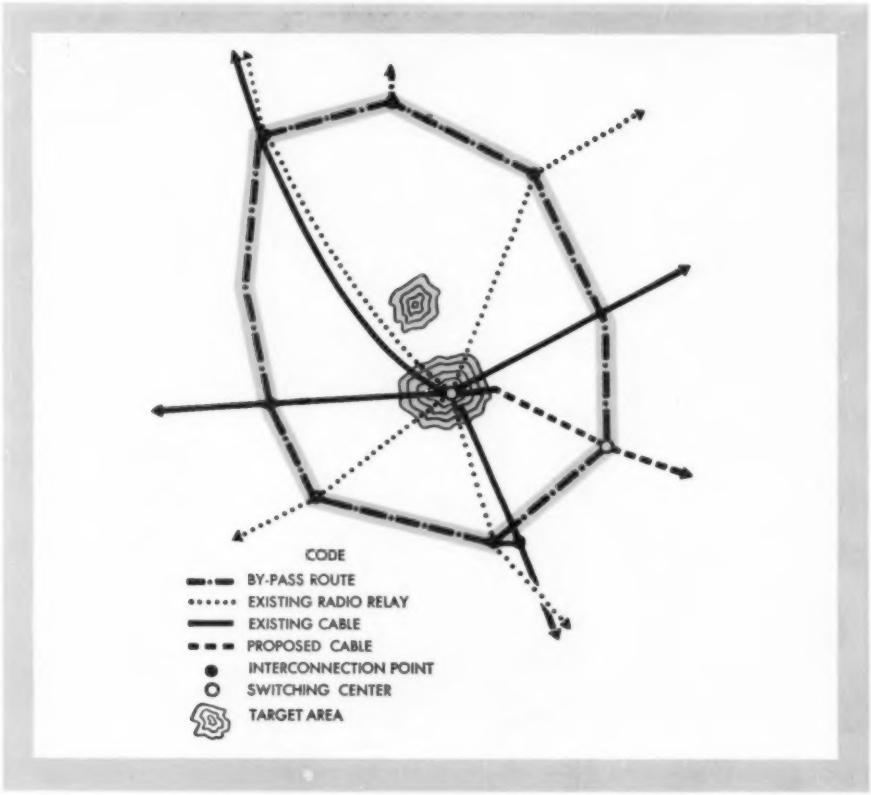
This is the headquarters of Sandia Corporation in New Mexico—the first Bell System major post-war project for defense. Since 1949, under Western Electric's management, various nuclear weapons have been produced for the Atomic Energy Commission



For the past three years the Bell System has been constructing routes which by-pass large cities and would thus avoid disruption of service in case of nuclear bombings

routes. As the network of telephone facilities spread, connecting every town and village in the country, it was relatively simple to route part of the circuits between any two points over separate lines. This worked all right—as long as we were dealing with individual emergencies. However, with the advent of nuclear bombing and the possibility of simultaneous bombing of many large communities throughout the country that might destroy a large number of cities, we realized that our long distance telephone facilities might be seriously crippled. This was because, until recently, our circuits had been routed for the most part through the centers of large cities along the way. Consequently, a by-product of widespread bombing of these cities would have been the disruption of the long distance telephone service.

About three years ago, we came to the conclusion that we should provide by-pass routes outside large cities, so that a portion of our circuits which formerly had all gone through these centers could be routed over such by-pass routes. Thus, in case the city itself was destroyed the flow of calls would not be unduly affected. In some cases it was necessary to construct new routes – called express routes – that



On these two pages are shown diagrammatically how telephone calls would be handled to avoid a large city (opposite) and to avoid its central area (above)

would avoid target areas. These communication avenues have branches leading into the cities along the way. As additional circuits have been required for growth, we have kept these considerations paramount in our plans.

The construction of by-pass and express routes is being undertaken by the Bell System to protect all of its services, both civilian and government. Part of this is required by construction needed for actual growth and the remainder to benefit the whole service. This project is well along and practically all of the by-pass and express routes will be completed this year.

When they are completed, we shall be able to route telephone circuits between any two points in the country without going through critical target areas. We will handle a portion of the normal commercial traffic between any two towns over these express and by-pass routes. Diversification will also be provided for essential military and other government circuits. Sufficient capacity is being built into these routes so that, in an emergency, all of the essential services can be placed on by-pass routes.

This is not a static program. Our plans are constantly being brought up to date as new goals are defined and enemy capabil-

A blast-resistant switching center on one of the nation's express long distance routes

ities increase. In some cases, where potential targets are created, we find out about them soon enough so that the location of our plant—a group of radio relay stations, for example—can be changed before it is built. In other cases, to avoid a newly constructed air base or other critical installation, we have to provide by-passes for the by-passes!

Emergency Protection

IN ADDITION to locating our express and by-pass offices away from other targets, we have provided storage batteries and stand-by power generating sets at each point. These make the offices independent in case of failures in commercial electric power.

Great advances have also been made in providing automatic equipment to restore circuits that have been interrupted, to start emergency power generating equipment, and to handle the nation-wide switching of telephone calls automatically without the use of any operators or maintenance men. These measures are particularly important in view of problems that might arise in connection with radio-active fallout caused by nuclear bombing.

Of course, if an enemy wants to expend the necessary weapons, we are still vulnerable to direct bombing attack on our buildings. The destruction of certain of them would be serious. However, we have a vast amount of emergency equipment that could be available for quick restoration. This is normally dispersed throughout the

country. For example, truck-mounted radio units are located at strategic points, readily available to replace microwave stations that might be destroyed.

These emergency offices are self-contained and include radio towers and power-generating equipment. Each of them can provide a microwave sending and receiving channel that can carry 600 telephone circuits.

Manpower

WHILE MACHINES AND EQUIPMENT are important, the tremendous resources represented by the 900,000 trained men and women of the communications companies should not be overlooked or minimized. These people—who are designing, manufacturing, building, operating and maintaining communication facilities—represent an indispensable pool of widely dispersed

Vast amounts of Bell System emergency equipment, dispersed throughout the country, are made available for quick restoration measures by vehicles of many types. Below are typical examples of such motorized equipment

and immediately available trained personnel ready to meet any emergency in communications.

At their command are vast amounts in equipment, material, and supplies spread throughout the nation. At any moment, there are literally hundreds of millions of dollars' worth of new equipment and supplies in factories, in thousands of supply depots, and in transit available for regular and emergency calls.

Disaster Plans

THE PEOPLE of the communications companies are familiar with the means to restore their facilities damaged by such disasters as storms, floods, fires, etc. They frequently handle this type of emergency, and practical arrangements for meeting them have been well established.

Fortunately, we have not been faced with the actuality of nuclear bombing. But we have been studying and rehearsing the measures that would have to be taken if this happens. For several years we have participated in all of the studies on this subject and in such exercises as "Operation Alert—1957," which simulated widespread nuclear bombing. During this exercise Bell System, Western Union, and other disaster centers were activated throughout the country. These centers evaluated the effect on communications of simulated bombing, as it occurred. They also set up re-routed facilities, as required, to restore communications necessary for military, government, and other essential needs. Such centers maintained immediate contact with the government organization participating in this exercise.

The 1957 exercise and others showed that the communication facilities now in existence would cover essential needs for the defense of the country. They also indicated that we have an adequate reserve to restore and rebuild any facilities which, if destroyed, would be needed after an attack.

From all the facts presented, I think you will agree that the commercial communications companies represent an essential part of the defense organization of this country. But we in the industry are not content nor complacent about the communications available today. I want you to know that we recognize our responsibilities for foreseeing and planning to meet fully all of our country's communications needs —now and in the future.

Bell System facilities help to gather and distribute facts received at many stations from satellites, and to pass on data to various study centers

COMMUNICATIONS IN THE U.S. SATELLITE PROGRAM

THOMAS D. NICHOLSON

Astronomer, AMERICAN MUSEUM-HAYDEN PLANETARIUM, NEW YORK CITY

NEWS OF THE U. S. NAVY'S first successful earth satellite was welcomed by a great many Americans on the morning of March 17, 1958. This was not the first man-made satellite, as had been planned several years ago, for it was preceded by the two Russian Sputniks of 1957 and by the U. S. Army's Explorer I in 1958. But there was still a good deal of scientific effort and reputation, and American prestige as well, wrapped up in the efforts of Project Vanguard. This was the program, directed by the Naval Research Laboratory, which had been planned by the United States to launch several earth satellites as part of our scientific contribution to the International Geophysical Year. Because of somewhat late starting, and several unfortunate failures in test flights of some of the equipment, Project Vanguard had developed a rather poor reputation. Fortunately, all that was changed on March 17th.

Minutes after the Vanguard three-stage rocket left the ground at Cape Canaveral, Florida, banner headlines carried word that it was in the air. At 7h 15m 41s, EST, the rocket began firing and lifted the 72-foot-long vehicle slowly upward. A little over ten minutes later, and about 1,500 miles away toward the southeast, the satellite was launched from the burned-out third stage, at 7h 26m 38s EST. Then followed long moments, and then hours, of waiting—waiting for the small bird to circle around the earth and come back, with its message of success. Finally, at 9:36 a.m. EST, word came from the Minitrack radio receiving station at San Diego, California. The radio signal had been picked up from the satellite and it was orbiting successfully. From a tiny antenna in the 3-pound, 6-inch baby moon, through the receiving antennas at San Diego, then through a communications network to the control and computing center at Washington, D. C., word of the successful launching finally reached the world. The position and a description of the orbit for the small Vanguard I were available minutes later.

Satellites would have no value for scientific purposes without means for observing their positions accurately, for acquiring

data from the instruments they carry, for swiftly passing this information to the control and communications center, and for distributing accurate predictions of future positions. In this vital link between satellite and scientist, Bell System equipment and developments from the Bell Telephone Laboratories and Western Electric Company play an indispensable role.

First of all, the radio link from satellite to ground makes use of two important developments from Bell Telephone Laboratories: transistors and the Bell solar battery. The small size and the weight limitations of the spherical satellites impose severe restrictions on the weight and size of the radio equipment they can carry and the battery pack which will be included to power them. Transistorized design has led to the miniature type of transmitters required for satellite purposes, and the solar battery, mounted in banks on the outside shell, will provide power for months or even years of operation.

On the ground, Bell equipment and communication lines make possible the far-flung network of communications which is needed to link satellite observing stations around the world to the computing centers that require reports of their observations. From two communications centers, at Washington, D. C., and at Cambridge, Massachusetts, reported observations of a satellite, coming from hundreds of stations around the world, are channelled to nearby computing centers. In turn, the same communication centers serve to disseminate to the scientific world the characteristics of the satellite orbit and then, back to the observing stations, predictions which are needed to continue tracking the satellite on its constantly changing path.

Actually, the rocket which left the launching pad at the Missile Test Center in Florida on St. Patrick's Day morning this year was not intended to launch a satellite. It was a test vehicle, No. Four in a planned series of six test launchings which were designed to test out the components of the brand-new Vanguard rocket under flight conditions. The Vanguard, built by the Martin Company of Baltimore, Md., had been test fired before, but never successfully in its complete form.

The Naval Research Laboratory had planned for some time, however, to include in its test vehicles a miniature satellite which might reach an orbit if the rocket should function perfectly. How well test vehicle No. Four succeeded is best demonstrated by the performance of the satellite which it did succeed in launching, in an orbit between 400 and 2,500 miles above the earth, destined to remain for perhaps ten years or longer. Scientists at the Naval Research Laboratory were so pleased with the performance of the Vanguard that they decided to forego further test firings in favor of proceeding directly to the program of launching the full-scale, fully instrumented, heavier satellites which had been designed for the program.

The Three Observing Systems

The firing of March 17 also tested another very important phase of the Vanguard program: the observation and communication network which had been planned and developed to collect and distribute satellite observations and predictions after a successful launching. Three basic satellite observing systems were organized, each with different methods and objectives. They are known as Moonwatch, Minitrack, and Photo-Track.

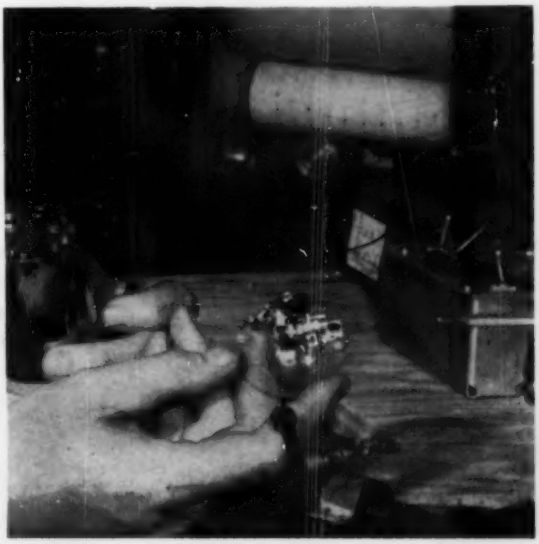
The Moonwatch program was designed to acquire the earliest visual records of a satellite's position, by using teams of amateur astronomers to cover the sky from

selected locations along the satellite path. A single Moonwatch team consists of several observers, each equipped with a special wide-angle, low-power telescope or monocular. Each observer keeps his instrument aimed at a fixed area of the sky, slightly overlapping the fields of his two neighbors, in such a way that the entire team keeps a vertical belt of the sky under constant observation. With favorable conditions, a satellite could not pass through the sky above a Moonwatch team without being observed by at least one member of the team. There are about 230 Moonwatch teams registered as official observing groups, 130 in the United States and about 100 in foreign countries. It is planned that Moonwatch teams will furnish the first visual evidence of a satellite's orbit. Their observations will be used to establish the earliest orbital data for a successful satellite.

Minitrack is another program intended to detect a satellite as early as possible after launching, but by radio rather than by visual means. Eleven Minitrack stations are in operation in this program, using highly directional equipment specially designed for the purpose by the Naval Research Laboratory. Each station receives a signal from a fan-shaped area extending above it in a general north-south direction. The stations are arranged to establish an unbroken "radio fence" across the path of a satellite, so that the satellite must pass through the receiving zone of at least one Minitrack station each time it travels around the world.

Minitrack serves two important functions in the Vanguard program. First, it provides early radio evidence of a successful launching, even before visual observations can be obtained, and continues to acquire observations as long as the satellite radio continues to transmit. Second, it monitors the modulations in the radio signal which are used to telemeter information from the scientific measuring instruments carried by the satellite, during the lifetime of radio transmission.

In the Photo-Track system, twelve photovisual tracking stations have been estab-



Held between the fingers of one hand is one of the actual radio transmitters which is now signaling to Minitrack stations around the world as the Vanguard satellite maintains its course in orbit. Essential to the miniature dimensions of the transmitters are the special transistors made to Navy specifications at Western Electric's Laureldale plant. Solar batteries of the type invented by Bell Laboratories power one of the transmitters

lished around the world. A specially designed Baker-Nunn Schmidt-type tracking camera—a fast, wide-field camera-telescope with rapid film transport—is located at each station. The camera will provide highly accurate photographic records of the satellite positions, after a preliminary orbit is obtained from other observations. The stations are located throughout the belt of the satellite path planned for Project Vanguard, to provide the greatest possible coverage of the satellite path. The observations provided by the Photo-Track cameras will be important in programs of satellite study, such as estimates of air density above the earth—the factor which causes the life of a satellite to be limited—and geodetic studies, which depend on accurate knowledge of satellite position and changes in its orbit. The value of the photo-visual observations will continue through the lifetime of the satellite, even after radio transmission has ended.

The Vanguard and Smithsonian Centers

TWO COMMUNICATION CENTERS are established for controlling these tracking systems. The radio tracking program is administered by the Vanguard Control Center at the Naval Research Laboratory in Washington, D. C. The Control Center maintains the channels of communications to and from all of the Minitrack radio observing stations. The nearby Vanguard Computing Center in Washington obtains its data from the Control Center and reports orbit information and predictions of future satellite positions back to the Control Center for distribution to the radio observing stations and to the scientific community.

The visual observing program is under the direction of the Smithsonian Astrophysical Observatory at Cambridge, Massachusetts. Smithsonian administers the Moonwatch program, the Photo-Track installations, maintains its communications center at Cambridge, and has its own computing facilities nearby for processing observations obtained through its systems.

This observation and communication program planned for Project Vanguard had several preliminary tests of its operations before the launching of the first Vanguard satellite this March. Following the successful launchings of the two Russian Sputniks of 1957 and of our Explorer I, the two centers and the observing programs they administered went into operation to obtain and maintain orbits for the objects. The first Sputnik, of October 5, 1957, found the centers only partly organized and without the equipment and staff that had been planned. Operations were necessarily rather makeshift and somewhat harried, until equipment and personnel became available. Even so, both Sputnik I and Sputnik II were in orbits quite different from those planned for the U. S. satellites, and were transmitting their radio signals on frequencies quite far from those which were to be used for Vanguard, and for which the Minitrack stations had been designed. Nevertheless, the two centers, at Washington and Cambridge, eventually solved the problems and began handling Sputnik observations and data in a routine manner. But they had not anticipated a satellite before the spring of 1958, so that they had not nearly approached operational status when they were required to begin work with Sputnik observations.

By the time the U. S. Army's Explorer I was placed in orbit, on Feb. 1, 1958, the observing programs, communication and control centers, and computing centers were better equipped and staffed and were organized to handle the work load reasonably well and as planned. With the

first Vanguard, the test satellite of March 17th, operations were quite smooth and normal.

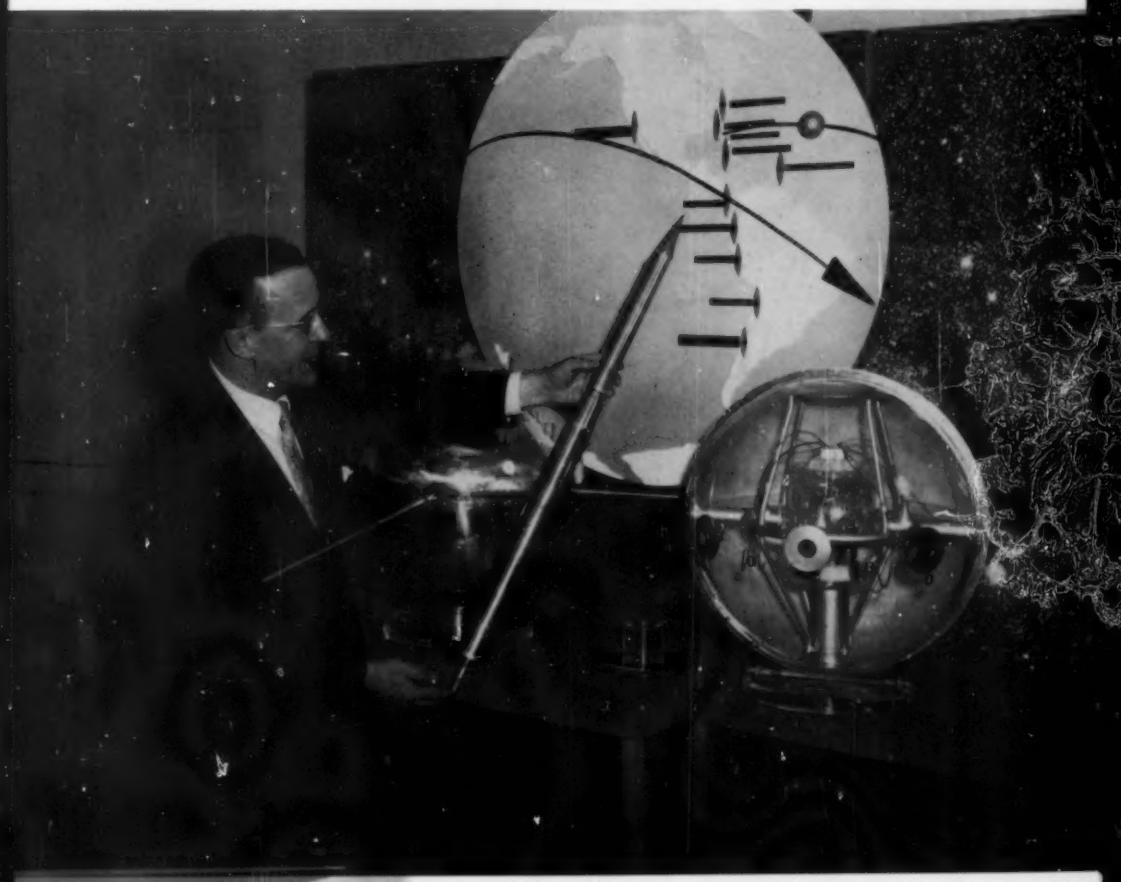
Special Communications Arrangements

THE COMMUNICATIONS CENTER at the Naval Research Laboratory is under the direction of Mr. J. T. Mengel. Its primary function is to service the communications needs of the Vanguard Control Center at the Laboratory between the eleven far-flung Minitrack stations and the Vanguard Computing Center in downtown Washington. It is staffed by Navy service operators on a 24-hour basis. Most of the communications are handled through 17 teletypewriter machines over land-line teletypewriter. It maintains private lines to each of the eleven radio tracking stations, through other systems in some cases, and to certain other information centers.

One teletypewriter machine operates in the Navy communication network, NTX. It provides a private channel to the Navy communication center at Washington, and it is the primary means of reaching the Minitrack installation at Woomera, Australia. Radio teletypewriter through U. S. Navy and Air Force relays are used between the center at Washington and the station in Australia.

Two commercial TWX machines are installed at the Vanguard center. TWX is used to reach the Minitrack station at Esselen Park, South Africa, via commercial radio teletypewriter from New York.

Dr. John P. Hagen, director of the Vanguard project, with a rocket model, satellite models, and a map showing Minitrack stations, to illustrate the manner of projecting the satellite into its earth orbit. (U.S. Navy photo)



The TWX machines are also used for routine communications and to exchange information with the center at Smithsonian in Cambridge, although the NTX machine can also be used for the latter.

Fourteen teletypewriter machines are on the Army Control Administration Network, ACAN. Three lines are used between the communications center and the computing center in Washington. These lines can be used to feed data directly to the IBM 704 computer at the center, without further processing, in the event that it is desired. Separate ACAN lines are also maintained to Minitrack stations at San Diego, California, at Blossom Point, Maryland, and at Ft. Stewart. Another line services the station at Havana, via overseas commercial cable from Key West, Florida. A direct line is maintained via the ACAN system to the launching site at Cape Canaveral, Florida, and thence to the Minitrack station at Antigua and to other tracking stations along the flight path of the launching rocket. One line is used to exchange information with the U. S. Army Map Service. Four lines are used directly to the ACAN control center in Washington, and thence, via ACAN radio teletypewriter to the Minitrack stations in South America, at Quito, Ecuador; Lima, Peru; and Santiago and Antofagasta, Chile. An additional ACAN line is available on a stand-by basis to communicate directly to ACAN control at Panama in the event of difficulty in the radio link from Washington.

At the Smithsonian Astrophysical Observatory in Cambridge, the communication center is under the direction of Mr. Charles M. Peterson. This center is staffed by civilian personnel, with operators also on a round-the-clock basis. Equipment maintained at the center includes one teletypewriter in the U. S. Navy NTX landline network, three commercial TWX machines, one machine in the Air Force communications network, and one commercial Western Union machine. The center also maintains four Bell System telephone turrets, from which operators can answer any of five business lines.

The communications center at Cambridge must service both Moonwatch and Photo-Track requirements. Alerts to domestic Moonwatch stations and reported satellite observations from these stations are handled, in the days immediately after satellite launching, by telephone, using the four Bell turrets. This provides the fastest means of obtaining the early visual observations which can be used to establish a preliminary orbit. Following the somewhat emergency conditions of the first days after launching, Moonwatch alerts and observations from teams in the United States are handled by the Western Union machine. Normal alerts predicting possible observations by Moonwatch teams are sent out from the communication center by its machine to Western Union, Boston, in book message form to one of six geographical lists maintained at the Western Union Office, or to several of the lists if conditions warrant. Returning observations from the Moonwatch stations in the United States are returned to the communications center by collect cable and code address, with maximum delay time in receiving the observation less than one hour.

Communications with the three domestic Photo-Track installations, at White Sands, N. M., Pasadena, Cal., and Jupiter, Fla., are handled by commercial TWX. This system is also used to exchange orbital information and predictions of satellite positions with the Vanguard Control

A diagram of a Moonwatch team in action, and a photograph of a watcher with the special telescope and mirror in use, so mounted as to project vision upward to a specific segment of the sky

Center at Washington. Commercial TWX is used to conduct the routine communications necessary in the administration of the Smithsonian Astrophysical Observatory, and to communicate with the various scientific institutions, domestic and abroad, which require data about the satellite or which may provide additional observations by radar, radio, or visual means other than those in the planned Vanguard program.

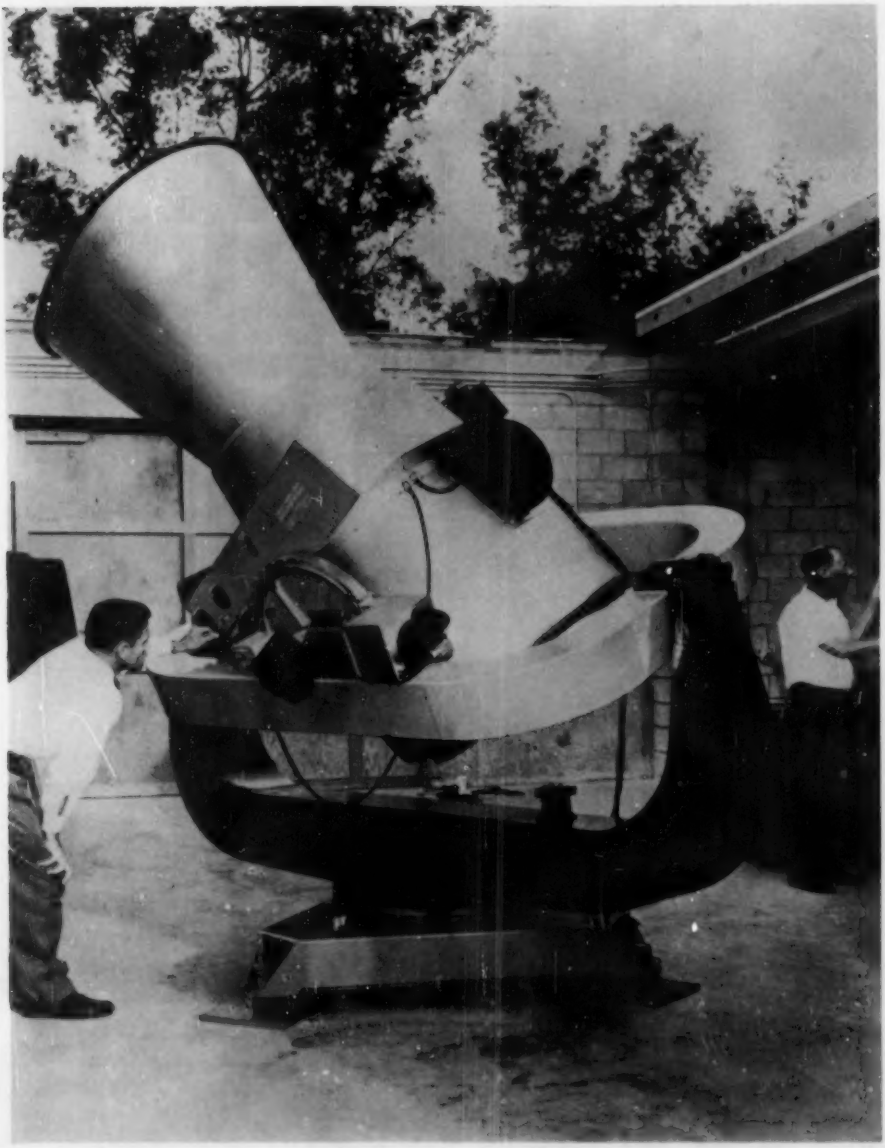
Independent radar and radio observations of a satellite are made at various U. S. Air Force stations throughout the world and are channeled to an installation called Spacetrack, at the Hanscomb Air Force Base, Bedford, Mass. The Air Force teletypewriter machine installed at the communications center in Cambridge is used to exchange all data, observations of satellites, alerts, predictions of satellite positions, and orbital elements, with the Spacetrack installation.

Overseas Routes

CHANNELS to foreign Moonwatch stations and Photo-Track installations from the Communication Center at Cambridge are quite varied and have been worked out for most efficient and economical exchange of information by Mr. Peterson for each individual location. Generally, commercial TWX is used to reach overseas commercial cable offices at New York and San Francisco. Thence by commercial cable, messages are exchanged with Photo-Track stations and with local group leaders designated to handle communications for all Moonwatch teams in the area. Wherever possible, however, Mr. Peterson has sought out government channels to use in communicating with the overseas installations wherever some U. S. Government station can be found conveniently located. In these cases, the Navy NTX channel is used, via Boston to the Navy communication center at Washington, to reach the appropriate government channel and station.

TWX and commercial overseas cable are used to reach Photo-Track stations at Curaçao; Arequipa, Peru; Naintal, India; Teheran, Iran; Pretoria, South Africa; and San Fernando, Spain; although alternate government channels can be used to South Africa, Iran, and Spain, depending on the urgency of the communications. Government channels are used to reach the Photo-Track installations at Cordoba, Argentina; Woomera, Australia; Maui, T. H., and Kokubunji, Japan. About 60 overseas Moonwatch groups are reached by TWX and commercial cable, and the balance through government channels.

As an example of the development of government communication channels to overseas observing locations, the route used to Moonwatch teams in Hawaii and to the Photo-Track station at Maui is interesting. Using the Navy NTX machine, the communications center at the Smithsonian Institute in Cambridge will transmit to Navy communications center at Boston, thence to the NTX center in Washington. From here, the message is channeled via Navy teletypewriter to the Honolulu Naval Base. The message is then phoned to the University of Hawaii, where Dr. Steiger serves as the leader of local Moonwatch groups. The message may also be given, if appropriate, by telephone or teletypewriter to the Civil Aeronautics Administration office in Honolulu. C. A. A. has a station on Maui, with teletypewriter service from its Honolulu office. The message is relayed by this C. A. A. teletypewriter network to the Maui office, and then phoned to the Photo-Track station on the island. Return messages are routed the same way. An alternate routing in emer-



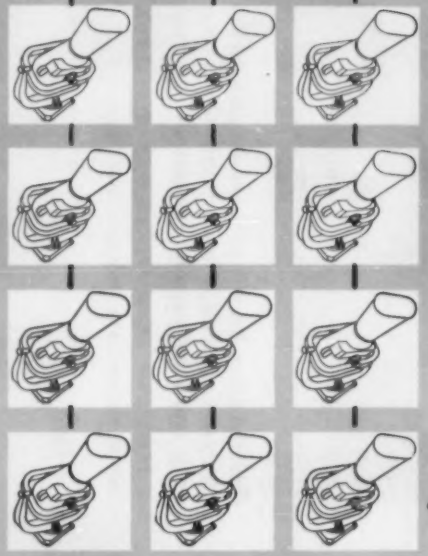
One of a dozen tracking cameras designed by Perkin Elmer Co. to plot satellite orbits with great accuracy. They will give information on air density, the true shape of the earth, and more accurate calculations of measurements between far distant points

SATELLITE OBSERVATION AND COMMUNICATION NETWORK

COMMUNICATIONS CENTER—CAMBRIDGE, MASS.

Photo-Track, Minitrack, Moon Observing Stations for US—IGY Satellites are controlled from Communication Centers at Cambridge, Mass. and Washington, D. C.

VANGUARD CONTROL CENTER—WASHINGTON, D. C.

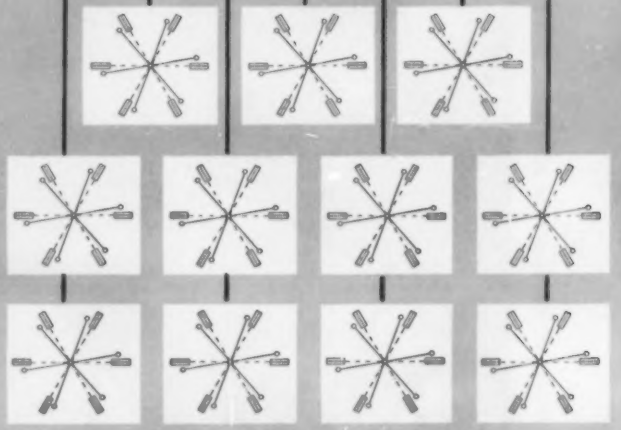


12 PHOTO-TRACK STATIONS

MOONWATCH STATIONS

130 DOMESTIC

100 FOREIGN



11 MINITRACK STATIONS

TELETYPEWRITER

CABLE

VOICE TELEPHONE

gencies would be by long-distance telephone from Cambridge to a Telephone Mobile Unit on Maui, and then by local phone to the Photo-Track station. All messages are later confirmed by mail.

To reach its observing locations in Japan, Cambridge goes by Navy NTX teletypewriter to Washington, then into the Army teletypewriter network to the Radio Research Laboratory at Kokubunji, Japan. The message is given by phone to Dr. Miyadi, Director of the Tokyo University Observatory, who then passes it by phone to Moonwatch teams in the area and by teletypewriter to the Photo-Track installation.

To the Jodrell Bank Experimental Station in England, from which valuable radar observations of satellites have come to Smithsonian, Navy teletypewriter is used to the U. S. Naval Communications Station, London, then to the British Ministry of Supply for transmission to the observatory.

In all cases where government channels are used to reach overseas observing locations, commercial teletypewriter and overseas commercial cable are used if the urgency of the message requires faster transmission. U. S. Government priority is given to satellite communications carried by commercial channels. The criterion for selecting either the faster commercial channels or the more economical government routes at the Smithsonian communications center is quite simple. All messages relating to predictions of satellite orbits or alerts of satellite position are required to arrive at their destinations a minimum of three hours before the expected passage of the satellite at the station.

Types of Information Handled

THE TYPES of information transferred in the communication system, either at the Vanguard center in Washington or the Smithsonian center at Cambridge, may be classified in several groupings. There are the routine communications involved in the administration of the agency. From observing stations, domestic and foreign, there come observations of satellite positions, from Minitrack stations to Washington, from Moonwatch and Photo-Track to Cambridge, from astronomical observatories and government installations observing visually or by radar to both. Out to the observing stations go messages relating to predictions of the satellites path and alerts to guide the observing stations in scheduling their observing periods.

All observations are submitted to the computing centers nearby for reduction, by teletypewriter at Washington, by hand at Cambridge, where the center is in the same building as the communications center. Predictions and orbital data are returned from computing to communications.

There is exchange of observations and of data from the computers between the two Communications Centers and with other agencies as well, U. S. Army Map Service, the Air Force Spacetrack center, and the U. S. I. G. Y. World Warning Center, AGIWARN, at Ft. Belvoir, Virginia. Finally, interested scientific and government agencies are informed, on a routine basis, of the predictions of satellite movement and the orbital elements of the satellite as these become available from the computing centers.

Words and More Words

THE VOLUME OF TRAFFIC, and the relative weight placed on the various means of communicating, may be observed in the

following monthy averages estimated by Mr. Peterson for his work at Cambridge. "Words" refer to units of 5 letters or 5 numerals.

Channel	*Words Carried Monthly*
TWX–Incoming	45,420
TWX–Outgoing	107,520
Overseas cable–Incoming	9,480
Overseas cable–Outgoing	26,580
Western Union (domestic)–Incoming	5,880
Western Union (domestic)–Outgoing	3,660
Military–Incoming	87,840
Military–Outgoing	99,870
Total	386,250

Following each successful satellite launching, the daily averages increase temporarily. A permanent increase in volume to over half a million words monthly can be anticipated with another successful Vanguard launching.

It must be remembered that Vanguard has as yet succeeded in launching only one small test sphere, with little scientific payload. Project Vanguard plans, within the time scale of the I.G.Y., which ends in December, 1958, call for the launching of four different satellite designs, with two launching efforts reserved for each to insure success. If the orbits of the future Vanguard satellites achieve anywhere near the permanency of the first test object—and there is every reason to believe that they will—the work load on the observing stations, and the consequent growth in communications volume, will increase far beyond the present level.

The Vanguard program is just one of the satellite projects being undertaken in the United States. The U. S. Army Jupiter Project has already launched two successful satellites out of three tries. Vanguard will launch several before the year is out. Beyond Vanguard, larger and more advanced satellite projects are in planning or development stage. It is worth repeating that a satellite which is unobserved is useless. In the present satellite programs, as they progress toward completion with more satellites, and in future projects, Bell System telephone equipment, and products of the Bell Telephone Laboratories and the Western Electric Company will continue to play a vital part in the link from satellite to ground to computer to scientist which will produce the data of scientific value for which satellites are planned and launched.

Community living is a built-in philosophy through which telephone people can make their jobs easier and local relationships generally more satisfactory

RAISING COMPANY STANDING IN THE COMMUNITY

F. HOBART WALKER

Employee Information Manager, PUBLIC RELATIONS DEPARTMENT, A. T. & T. CO.

WERE YOU ever hopping mad at some mistake, oversight, or rudeness, by a business firm toward you, a customer? Was it a laundry employee, telling you that the buttons were already off that shirt before you brought it in? Was it a plumber (minus tools) saying that your old sink wasn't worth fixing? Was it a saleslady who intimated that the article you wanted (and that they couldn't supply) was the sort of thing only an odd character would ask for anyway?

This is the stuff of which apoplexy is made. More weight has been lost by sheer fury over this kind of thing than by any number of diets.

Needless to say, almost all businesses recognize that it's these little things that can make them or break them. And they've given a lot of attention to the problem of minimizing annoyances that will drive their customers into the waiting arms of a competitor.

In the telephone business, when we irritate people, they can't go across the street and buy telephone service. But they can think less well of us – and in the long run that can hurt! This is an old story to all of us. We have long been aware of our particular – and peculiar – requirement to go all-out in satisfying our customers. And we have accomplished this aim remarkably well over the years.

We can all agree that our first responsibility is to give top-grade telephone service at a fair price. But does our obligation stop there? The old saw about a shoemaker sticking to his last becomes less and less applicable in the complex world we live in today. There is no such thing as operating in a vacuum.

The social pattern is changing

THE ACCEPTANCE of more and more responsibility by business for the health, welfare, and happiness of America is one of the biggest *plus* signs coming out of this twentieth century.

What seemed right to the businessman of the late 19th century no longer seems

right to us today. It may be that what seems eminently good and adequate to us now will appear quite different to a succeeding generation. Many of the values and interpretations of a generation ago don't seem sound today because our country's social structure has changed. It is continuing to change. That's why we continually have to take stock of where we stand, make sure that our responses to local needs and changing conditions are adequate. And that's why we have all been doing a lot of thinking and talking in recent years about the concept of "community living."

There is nothing new about it. But we have to make sure that we are doing enough of it – and in the right way.

What is community living?

Community living is everything we do and say which, from the community's point of view, serves the community's interests.

That's a pretty broad statement. It covers a lot of ground. In order to discuss aims, find out where we had been, and where we were going, it was necessary to define this philosophy more clearly. So, broken down into its components, we say that community living means –

SERVING . . . provide efficient, friendly telephone service that includes doing the "little things" not fully required, and avoids rigid application of routines.

For example –

. . . the operator, supervisor or service representative who goes beyond normal requirements to complete a call or

A customer asks a final question of members of the local operating team, following "town meeting" where company-community problems were discussed face-to-face

provide information.

. . . the acting chief operator who, on weekends, takes the number of customers calling the business office and arranges for a call-back on Monday, instead of merely saying, "The business office is closed."

. . . the plant chief who takes over the Traffic-initiated service calls for several weeks in order to get first-hand information on a central office maintenance problem.

SHARING . . . participate in worthwhile activities both as a company and as individuals, and beyond this, help to solve community problems in the knowledge they are our problems.

For example –

. . . holding memberships in civic clubs; contributing to and participating in community activities.

. . . the accounting people who offer to help set up accounting procedures for a community fund drive.

. . . first aid and safe driver training for civic groups, women's clubs and teenagers.

. . . offering the use of company cafeteria, auditorium or meeting rooms for worthy causes; or helping put up poles for the community athletic field.

KNOWING . . . be aware of how the community feels about us – what it thinks and expects.

For example –

. . . the searching of all available reports for clues as to what our customers think of us.

. . . discussions with employees on local results of customer attitude surveys.

. . . employee get-togethers in unattended dial office towns to discuss the problems and questions raised by local customers.

ORGANIZING . . . through local authority and planning, enable telephone people in town to have the information, responsibility and opportunities to build better relations between company and community.

For example –

. . . the local team members sharing responsibility equally.

. . . higher management encouraging and supporting the local team in taking action.

. . . inviting vocational people to contribute their ideas and to participate in company initiated community activities.

. . . making sure that all employees have the information to help them answer questions from friends and neighbors.

INFORMING . . . tell the community what we do, and why, so people understand our work and our intentions.

For example –

. . . telling about our plans, problems and results to all possible groups.

. . . use of talks, films, central office visits, exhibits.

. . . use of Telezonia and Teletrainer in schools.

. . . localizing press releases, advertising, window displays.

How can we know how the public feels about us?

FOR OVER a decade, the Customer Attitude Trend Surveys have given us a periodic measure of the way people feel toward telephone service, cost of the service, and the company generally. This has given us a sort of running, quantitative record of our success or failure in improving customer attitudes; it has also given us, through "write-in" comments by the respondents, some valuable clues on the things that please or displease our customers.

In addition, an increasing amount of sociological research has been carried on in recent years by various research firms, for the Bell System and for other businesses. The kind of research referred to here is not the old-fashioned "daisy" type: that is, the "he likes me, he likes me not" kind of study that asks a general question of a lot of people and then totes up the score. Rather, it's the kind of research that finds out not only *how* people feel, but

also a little of *why* they feel that way.

I say a *little* of why they feel that way, because the "why" of attitudes is tremendously complex. Suppose a man states that he "doesn't think the telephone company is run very well." It might be that the real reason for making such a statement is that he had a recent unpleasant argument with his wife about the size of the telephone bill! In other words, people often make flat statements that sound like well-founded logic, yet which are based on insignificant or unrelated emotional experiences.

This leads to difficulty in determining the reactions of the public. Not everything we do that affects attitudes can be strictly measured. There isn't always an obvious cause and effect relationship. Sometimes the gap in time between cause and effect can be months and years.

In the Bell System there are engineers, scientists, accountants, technicians of the highest order. They often find opportunities to share their skills for the good of the community. Promoting interest in science among young people is an example

Even so, the mass of research data accumulated over the years has added to our understanding of the things that account for people's feelings, and some pointers as to what we can do about improving those feelings.

Some general truths stand out clearly

MOST ATTITUDES of the public are grounded on personal experience with service. Service is the starting point.

Incidents connected with telephone service – both favorable and unfavorable – can make decided and lasting impressions on people's telephone attitudes.

The public rates us high as to our service and higher still as to our "desire to serve." This is well-deserved approval. Yet the very precision of our operation – "a rule for everything" – can throw a shadow over the generally favorable image.

The telephone company is often seen as "proper"; a business that conforms, and demands conformity from its customers. It is not a flexible company, people say.

Whenever we see a loss in favorable attitude, it is usually because the rigidity of our operation has not been counterbalanced by personal consideration. On the other hand, whenever we find exceptionally favorable attitude, it is usually because the customer recalls some warm, friendly service experience.

We know that service-connected experiences are the prime movers of public attitude – for good or bad; and the rigid following of company practices is one factor that contributes to lower attitudes on the part of the public.

Everything that happens to our customers is local in nature. Only local telephone people are in a position to know whether those things are good or bad – and only they can do anything about it.

So the keystone of our success with the public at large is the expanding of authority for the local telephone team.

The community living concept requires the care and cultivation of local initiative. Only with this can the local management group *look critically* at the company's over-all behavior through the eyes of the community and take or recommend action which will lead to a more friendly, interested, and efficient company.

The concept requires recognition at all levels that this initiative – this critical, inward look and subsequent action–is essential to long-run effectiveness; that it is the foundation for success in attaining our business aims.

Employees play a major role in forming customer attitude

THE PUBLIC measures quality of service not only on whether it is errorless and prompt but also on whether it is given in a friendly, natural way. Small extra things loom large in the public memory; and virtually all experiences of this type involve personal contact with employees.

The telephone employee has a strong effect on public attitude off the job, as well as on. In such company-related activities as open houses and central office visits, improved customer attitude seems clearly related to the face-to-face nature of the event.

Away from the company premises, too, employees are a frequent source of information about the company among friends and neighbors. Research shows that customers who know employees are certainly more able to express their attitudes toward the company – less likely to have "no opinion" about the company. But, though employees' influence is mostly favorable, it can be negative or a mixture of both. The way an employee feels about his own job is an important factor in the way he talks about the company.

Are we big or little?

STRANGELY, the telephone company presents a double image as to size: sometimes national and big; sometimes local, almost invisible.

The bigness and nation-wide character of the telephone company are seen by most as signs of efficiency and the strength to serve well. A monopoly, yes; but expected to be different from other "competitive" big businesses. The public does not see us as an aggressive organization, out to gain its own ends.

However, people can also see in our size the *possibility* of power difficult to control, of a company more interested in itself than in its customers. This possibility is not uppermost in people's minds. But it

He may never know anything about decibels, rate of return, or the Plant Maintenance Index–but his experience with telephone service and people will give him an opinion that can help us or hurt us in the years ahead

is there, ready to rise to the surface. For example, a man watching a fleet of telephone trucks mobilized to restore service after a catastrophe might say: "There's a fine, big outfit." But suppose that several weeks later the same man is faced personally with some service shortcoming or an inflexible company rule against which he feels powerless: His first reaction is likely to be "monopoly" – with all of that word's worst connotations.

It is like the big man who is described by his friend as a "great strapping fellow," and by his enemy as an "ugly brute." Mere size, of course, has nothing to do with it. It is the way the giant *acts* that counts.

The same people who think of us as big and national in a favorable way can simultaneously see us as small and subordinate on the local scene. When you ask Mr. Average Citizen to name the "important" companies in town, he's likely to think of the big factory, large groups of employees, and other visible, tangible things. In this sense, the telephone company can be small and unimportant. Our facilities are spread all over town; our buildings are modestly identified; our employees are seldom seen in large groups.

Our problem here, then, is to build our visibility on the local scene, showing interest in home-town affairs, so that we are known as a local force for good in proportion to our actual size.

People like us big—they approve of our strength to serve. But they don't want us so big that we overlook their *problems*

The public does not stand up and cheer our good deeds

It is something of a paradox that while the public expects more and more of business in the way of community service, and expects us to do our share, it seldom expresses approval of our deeds in any specific way.

Does this mean that the civic deeds we perform are unimportant? Not at all. We fall heir to a certain amount of civic responsibility whether we like it or not. We may not be cheered for what we do today, but we can certainly be blamed severely for what we failed to do yesterday. And our concern in community living is to make certain that tomorrow will not find us lacking.

Community leaders have more specific expectations

While the general public may be largely unaware of the part telephone people play in such socially necessary activities as fund drives, civic committees, and so on, there are certain leader groups in every community who are well aware of the amount and nature of our participation.

Interviews with business and community leaders are likely to reveal that telephone personnel are looked on as "able, helpful, coöperative." Yet many times this favor-

There are all kinds of people—but they all recognize the plus value of friendly service. It's often not so much what *we do as the* way *we do it that counts with customers*

able image will be clouded by the notion that local telephone people lack local authority.

Our business is built on a complex set of rules, all designed to assure good service. So far – so good. But do we sometimes try to apply a rule where none exists? No rulebook can ever be written to cover all the things that happen daily in our dealings with customers. That is why it is so important to be sure that the local telephone group has the authority to act in a natural and responsible manner – on the spot.

Most everyone knows what is the right and natural thing to do in any one circumstance. One major block to action is uncertainty as to how it will be taken "up the line." Perhaps the following example points this up:–

In one exchange a wire chief was asked to arrange for use of some company equipment to help set floodlight poles for a community ball park. The wire chief agreed, with some misgivings.

Later, the gratitude of the community came to the attention of the wire chief's boss. In a telephone conversation, the boss congratulated his wire chief on making such a good impression in the community. Somewhat as an afterthought, he asked why he hadn't been told about the project. The wire chief said,

"It just seemed like something we really ought to do and—well, to tell you the truth, I didn't know whether you'd feel you could go along with it." To which the boss replied: "I'm glad you didn't ask me!"

Community living is not a "Program"; it's a frame of mind

COMMUNITY LIVING does not mean we should suspend good business judgment. We want to serve the community as businessmen, not humanitarians or social workers.

We are in business to give telephone service, the best telephone service that is within our ability to provide. In order to do that job today and meet the ever-increasing demands of the future, our operations must be profitable. This is in the best interests of all—customers, community, employees, share owners.

The important thing is that we base our intentions on *wanting* to serve in a broad sense and work constantly in that direction, demonstrating genuine interest in people and community.

It is difficult—perhaps impossible—to relate community living directly to more efficient and economical operations or additional sales of our services and equipment. It seems to make sense, though, that we can accomplish these things both better and more easily when people have confidence that we will be fair, friendly, and sensitive to their viewpoint.

INDEX NOW AVAILABLE

AN INDEX to Volume XXXVI (1957) of the BELL TELPHONE MAGAZINE may be obtained without charge upon request to the Public Relations Department of the American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.

The MAGAZINE is also reproduced on microfilm: one volume to a single roll of positive film, on a metal reel, suitably labeled. Inquiries concerning microfilms of the MAGAZINE should be addressed to University Microfilms, 313 N. First Street, Ann Arbor, Mich.

Of the more than 200 countries which report telephone facts and figures, eight have consistently maintained the highest development

THE WORLD'S TELEPHONES: A STATISTICAL VIEW

ELIZABETH WRENSHALL

Chief Statistician's Division, COMPTROLLER'S DEPARTMENT, A. T. & T. CO.

AT SOME POINT between cheery holidays and doleful tax payments each year there appears a booklet issued by the A.T.&T. Company listing, among other things, the number of telephones last reported by each country. A seventeen-page report called "The World's Telephones," consisting of tables and charts, a copy may be yours for the asking. The Public Relations Department will be glad to oblige.

We in the United States telephone more often than we write letters. We have more telephones than all the rest of the world, and we use them with increasing frequency. We averaged 426 calls per person during 1956 as compared with 303 ten years earlier.

Seventy-five per cent of all telephones outside North America at the beginning of 1957 were government-operated. At least another ten per cent, officially listed as being under private operation, were only quasi-private. That is to say, a government administration owned the system, either wholly or partially, but appointed a board of managers to operate it autonomously. In this country, where business is free to serve the public, the telephone industry, privately operated, made 35 telephones available to every hundred persons. In Europe, where nearly all of the telephones are operated by government administrations, there were six per 100 of the population, and for the world in general there were four.

In terms of telephone density, or number of telephones in proportion to the population served, the United States has led other countries each year without exception. Sweden has been second among the telephonically important countries since World War II and Canada has been third, while New Zealand and Switzerland have had almost identical developments, occupying fourth and fifth place interchangeably. Denmark, Australia, and Norway have followed; usually, though not always, in that order.

Prior to World War II, Canada consistently ranked second in telephone density, Denmark or New Zealand being third or fourth. Sweden was fifth. Australia, Switz-

erland, and Norway took the next three positions.

Thus it may be seen that the eight countries named above have consistently had the highest telephone development in the world; that there have been changes in relative position for every country except the United States, which has always been first; and that Sweden has advanced from fifth place to a close second.

We have eight times as many

As REGARDS absolute numbers of telephones, the United States has led by a wide margin. At January 1, 1957, we had eight times as many telephones as there were in the United Kingdom, which has had the world's second-largest system since World War II. Before the War, Germany's system was next to ours in size, and the system serving the United Kingdom was third.

The accompanying table captioned "Countries Reporting One Million or More Telephones on January 1, 1957" gives some idea of telephone growth over a ten-year period. It reflects the remarkable reconstruction of damaged plants in certain of the war-torn countries.

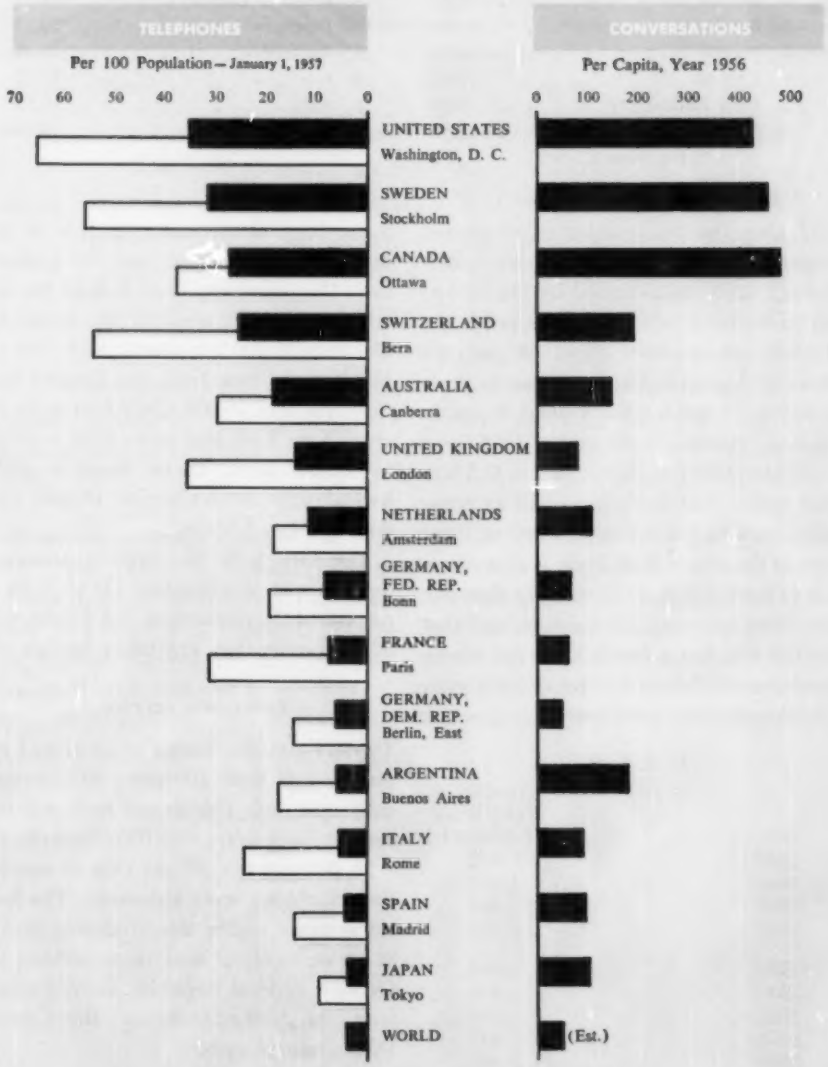
The question often arises as to the size of the telephone system in the U.S.S.R. At the time of publication of "The World's Telephones," no official statistics of the U.S.S.R. had been received. The Ministry of Communications last reported data to us for January 1, 1936, at which time there were 861,181 telephones.

A book which has just been received, entitled "Transport and Communications in the U.S.S.R.," published in Moscow in

COUNTRIES REPORTING ONE MILLION OR MORE TELEPHONES ON JANUARY 1, 1957

Country	Total Telephones 1957	1956	1947	Per Cent Increase 1957 over 1956	1957 over 1947	Telephones per 100 Population 1957
1. Argentina	1,155,198	1,127,933	601,018	2.4	92.2	5.87
2. Australia	1,762,173	1,653,149	881,462	6.6	99.9	18.48
3. Canada	4,502,326	4,151,678	2,026,118	8.4	122.2	27.56
4. France	3,313,426	3,116,697	1,997,335	6.3	65.9	7.57
5. Germany, Dem. Rep.	1,066,582	1,042,541	(3)	2.3	(3)	5.98
6. Germany, Fed. Rep.	4,323,225	3,985,212	1,472,900	8.5	193.5	8.26
7. Italy	2,609,127	2,329,139	831,854	12.0	213.7	5.40
8. Japan (1)	3,486,821	3,123,449	990,874	11.6	251.9	3.84
9. Netherlands	1,229,174	1,117,186	494,000	10.0	148.8	11.22
10. Spain	1,199,078	1,087,175	477,886	10.3	150.9	4.09
11. Sweden	2,312,223	2,219,075	1,314,117	4.2	76.0	31.50
12. Switzerland	1,293,743	1,214,640	697,589	6.5	85.5	25.50
13. United Kingdom (1)	7,218,791	6,879,511	4,304,595	4.9	67.7	14.04
14. United States	60,190,377	56,243,206	31,611,280	7.0	90.4	35.45

(1) March 31, 1957 (2) June 30, 1956 (3) Not available



Countries Reporting One Million or More Telephones

COUNTRIES OR AREAS WITH 15 OR MORE TELEPHONES PER 100 POPULATION

(12,000 OR MORE TOTAL TELEPHONES) — January 1, 1957

1. United States	35.45	7. Channel Islands	24.57
2. Sweden	31.50	8. Denmark	20.52
3. Hawaii	30.10	9. Australia	18.48
4. Canada	27.56	10. Norway (2)	17.75
5. New Zealand (1)	25.59	11. Alaska	17.52
6. Switzerland	25.50	12. Iceland	17.44

(1) March 31, 1957 (2) June 30, 1956

1957, gives the total number of telephones connected to local and rural central offices through 1956. As indicated by the following table, the number of telephones in the U.S.S.R. has increased about 140 per cent since 1937, as compared with an increase of 210 per cent for the United States in the same period. At the end of 1956 there were 2,067,000 telephones in the U.S.S.R. This means that there were half as many telephones in the entire country as there were in the city of New York. It also means that in the U.S.S.R. there was less than one telephone for every 100 persons, and that the U.S.S.R. has a much lower telephone development than any other country with a million or more telephones.

U. S. S. R.

Year	*Number of Telephones (Thousands)*
1937	872
1940	1,225
1950	1,410
1951	1,500
1952	1,598
1953	1,686
1954	1,816
1955	1,932
1956	2,067

Cities

IT IS, perhaps, not surprising to find that New York City had more telephones than any other metropolitan area in the world. Some idea of the concentration of telephone facilities there may be gathered from the following: Over half of the 200-odd countries or areas of the world had less than 15,000 telephones each. Yet one building in New York, the Empire State Building, had 16,000. Only four cities besides New York had more than a million telephones each. These, listed in alphabetical order, were Chicago, Detroit, London, and Los Angeles.

The city with the highest telephone density was Washington, D. C. with 65 per 100 of the population. Stockholm, with 56, had more than any other foreign city.

Automatic service

TWENTY-TWO COUNTRIES or areas had systems which were 100 per cent automatically operated. The largest such was that serving Hong Kong, with 63,760 telephones.

In 48 countries, 90 per cent or more of the telephones were automatic. The largest systems within this grouping, ranked in order of size, were those serving the German Federal Republic, Italy, Switzerland, the Netherlands, and the German Democratic Republic.

Connecting service

MOST OF THE other telephones in the world can be connected with those in the United States.

CONTINENTAL AREAS

Area	Total Number	Total Per Cent of Total World	Total Per 100 Population	Privately Operated Number	Privately Operated Per Cent of Total Tels.	Automatic Number	Automatic Per Cent of Total Tels.	Connecting With Bell System Number	Connecting With Bell System Per Cent of Total Tels.
North America	64,723,700	59.9	34.7	64,046,000	99.0	55,719,800	86.1	64,711,300	100.0(1)
Middle America	772,800	0.7	1.3	695,700	90.0	596,500	77.2	761,000	98.5
South America	2,695,300	2.5	2.1	1,268,600	47.1	2,229,000	82.7	2,603,200	96.6
Europe	32,606,600	29.7	5.8	5,218,100	16.0	25,957,000	79.6	30,159,300	92.5
Africa	1,546,100	1.4	0.7	22,400	1.4	1,091,500	70.6	1,359,500	87.9
Asia	4,929,900	4.5	0.3	3,521,900	71.4	2,889,800	58.6	3,602,800	73.1
Oceania	2,525,600	2.3	16.7	178,400	7.1	1,794,700	71.1	2,513,700	99.5
World	109,800,000	100.0	4.0	74,951,100	68.3	90,278,300	82.2	105,710,800	96.3
United States	*60,190,377*	*54.8*	*35.4*	*60,190,377*	*100.0*	*52,216,182*	*86.8*	*60,187,359*	*100.0(1)*

(1) Virtually all connect

January 1, 1957

Bell System overseas service was extended during 1956 to Kuwait, Jordan, and Saudi Arabia; 1957 to Libya, Ethiopia, Ceylon, Viet Nam, Fiji, Bulgaria, British Virgin Islands, Netherlands New Guinea, and Saint Helena; and, up to the time of writing, to Martinique and Afghanistan in 1958. Facilities were available, and contractual arrangements had been made, for connecting service between the United States and 126 other countries. The existence of a global network, gradually encompassing all habitable lands, is testimony to practical international cooperation.

The nerve center of operation of this country's 14,000 hotels, with assets of six billion dollars and 1,400,000 guest rooms, is the telephone

HOTELS: ONE MORE IN THE INDUSTRY STUDIES SERIES

ELDON C. HANES

Division Manager-Suffolk, LONG ISLAND AREA, NEW YORK TELEPHONE COMPANY*

WRITING IN THE Summer 1957 issue of this MAGAZINE, Frederick C. Smith, sales promotion engineer in the O. & E. Department of the A. T. & T. Co., described a broad program of Industry Studies being undertaken by the System companies. He characterized these studies as taking "... a whole new fresh look ... at the present and future communications requirements of the major types of industrial and commercial organizations."

Taking this "new fresh look" at the communications requirements of our large customers have been groups of telephone people representing all departments in our business. In most instances these Industry Study "teams" have been headed by Commercial and Engineering representatives who have been assigned to the program on a full-time basis. Other departmental people have served on a part-time basis as members of advisory committees.

Although many of the studies are currently nearing completion, the Hotel Study is one of the few where initial work has been concluded and sufficient time has elapsed to gain perspective on some of the more immediate results.

THE HOTEL INDUSTRY of today has grown from small beginnings to a business which has combined assets in excess of $6 billion. These represent the land and physical equipment of more than 14,000 hotels scattered over the length and breadth of our country.

On any given night these hotels can house more than 2,000,000 guests in their 1,400,000 rooms. In an average year they greet – and serve the needs of – more than 250,000,000 guests.

To maintain their physical plant and provide the services required by this vast army of guests, the industry last year spent more than a billion dollars in wages, bought $500 million worth of food and beverages, and worked around the clock every day of the year.

The foundations of this huge modern business were laid many years ago with the establishment of the first small seaport and post-road inns. These were primitive

*Until March 1, 1958, Mr. Hanes had been industry study engineer in the sales promotion section of the commercial division of the Department of Operation and Engineering of the A. T. & T. Co.

"No more room." Quarters in a primitive hostelry of an earlier day

affairs indeed: four persons to a bed, unheated rooms, straw mattresses, and primitive dining facilities – such was the order of those times. Mighty uncomfortable by our modern standards, but gratefully received by the traveler of an earlier day.

Down through the years, starting with the inn and extending to our present-day hotels, there has been constant effort to improve physical arrangements, management methods, and particularly guest services.

With the invention of the telephone, hotel managements of that era saw an opportunity to improve guest service. The earliest recorded installation of telephone service in a hotel which I have been able to uncover was made in the George Hotel in Black Rock, Connecticut, on June 15, 1878. Other installations were made that same year in the Continental and Girard Hotels in Philadelphia, and in several hotels in Boston.

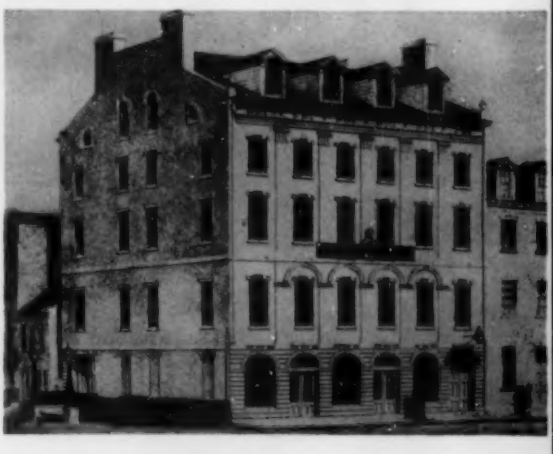
Today the nerve center of hotel operation is the telephone. Most of the services offered guests depend in large part on the availability of speedy, reliable telephone service. Whether the guest wishes a reservation in a distant hotel or just wants the latest newspaper sent to his room, the telephone is the link between the guest's wish and some action by the hotel staff.

In laying out the dimensions and direction of the Industry Study program, it was evident that the hotel industry should be one of the first "ports of call." Hotels had become valued and important telephone customers over the years, and developments since the war had been such that the hotel business had undergone tremendous change. In this atmosphere, two System companies undertook studies of units of the two largest hotel chains.

Work begins at two hotels

PRACTICALLY SYNONYMOUS with the name "hotel" to the average American mind are the magic words *Waldorf-Astoria*, a member hotel of the Hilton chain. The Waldorf, with its 2,200 rooms on 47 floors, repre-

The Franklin House once stood on the site now occupied by A. T. & T. headquarters



Long Distance simplifies making reservations ahead, from one hotel to the next

sents one of the largest single hotels in the world.

Inquiry by New York Telephone Company people disclosed that the Waldorf would gladly coöperate in a detailed study, and arrangements were made to get a study program under way in the big and famous hotel.

At about the same time the New York Company was laying its groundwork with the Waldorf, things were stirring a few hundred miles to the north, in Boston. Here, in the home town of the second largest chain in the country, Sheraton Corporation of America, New England Telephone Company people were busy making plans for a study of all hotels in the chain.

Sheraton management, like Hilton management, shared a belief that the place of the telephone company's services in their operation was an important one. They also recognized that the hotel business was in a state of transition which made it imperative that they plan not just for today's operation but also for the future.

With this background, the scene was set for the launching of this study with the consent and helpful coöperation of Sheraton management.

The teams at work

THE TRANSITION to actual study work was made quite rapidly by both the New York and New England Companies. Industry Study teams were appointed and went to work studying the two hotels' operations. The faces of the team members quickly became familiar to hotel staffs—from the bell captain to the general manager.

The first order of business for all the Industry Study teams has been to develop an understanding of the organization and responsibilities of the various departmental groups which make up the business. This knowledge is of vital importance in putting all the bits and pieces together and finally arriving at conclusions which accurately represent the real needs of a business as seen not by an outsider but by a person intimately familiar with both the day-to-day problems and the long-range objectives of the business.

The work of the hotel study teams extended over many weeks; it involved at various times special assistance from Traffic people, Statisticians, Public Relations people and many other departments. Frequently it required the services of people in other Bell System companies when special information on aspects of hotel operation in other cities was involved.

The end products are certainly the base on which we should judge the results of this intensive effort. These fall into two major categories: the development of new communications concepts, and the long-range benefits which will accrue both to the System and to the hotel industry as a result of the studies.

New communications concepts

HOTELS HAVE, since the turn of the century, employed manual P.B.X. systems to furnish telephone service to their guests. While these systems have served well, telephone people have for some time felt that hotel guests should be able to enjoy the advantages of dial service. One of the major obstacles to providing this service was the need for a method to charge guests for calls made from rooms. A "break through" came when New York Telephone Company engineers, working on this problem with the Industry Study team, developed the concept of installing message registers (similar to those used in our central offices) in hotels that would record the number of local calls originated from each guest room.

Screening equipment was then engineered that would examine each local call, pass the proper local area code numbers for completion, and at the same time transfer all other calls to the hotel P.B.X. attendant for further handling. Now guests needed only to dial "9" before dialing the local number they wished.

The next step – arrangements which would allow guests to place long distance calls without assistance from P.B.X. attend-

A recent development locates message registers from guests' telephones in the hotel's accounting office

ants – was accomplished simply by having the guests dial "8" and furnish the details of their calls directly to long distance operators. After completion, billing information on the calls is furnished immediately to the hotels' cashiers for entry on guests' bills.

The Hilton and Sheraton people were impressed with the possibilities of dial service. However, they came to slightly different conclusions as to the detailed arrangements they would prefer.

The Sheraton group felt that guests should, in addition to dialing local calls and long distance operators, be able to dial other hotel guests on a room-to-room basis. As a starter, they requested that service with these arrangements be installed in the Sheraton Plaza Hotel in Boston, where their headquarters people could gain first-hand experience with the system and evaluate the merits of installing it in other Sheraton hotels in this country and Canada.

On the other hand, Waldorf management felt that there might be instances when telephone calls between rooms could cause annoyance to guests unless controlled by their P.B.X. attendants. They also felt the amount of room-to-room calling was relatively small when compared to the volume of local and long distance calls placed. They preferred that guests dial "O" and ask the operator when they wished connections with other rooms.

As definite plans for dial service at the Waldorf were developed, another service innovation took form – the "one-digit" concept. To explain this new concept, you will recall that numbers "8," "9," and "O" were established as the numbers guests would dial to reach long distance, to dial local calls, or to reach the hotel P.B.X. operator. A proposal was made that each

The "one digit" call system connects the guest with whichever service he desires

A "message waiting light" on a guest's telephone when he enters his room notifies him to call the message-center attendant

of the seven remaining numbers on the dial be used to reach frequently called service locations in the hotel. By placing a specially printed disc beneath the finger-wheel of the dial, each service could be readily identified and associated with the corresponding number on the finger-wheel. For example: #1 for Message Desk, #2 for Room Service, #3 for Valet, etc. Waldorf management liked the idea because it eliminated the need for a separate directory or complicated instructions, and it was incorporated into their dial system.

Both are working well

How WELL are these two systems working? What about guest acceptance?

The answer to both questions is strongly in the affirmative.

Sheraton conducted a number of interviews with guests in the Sheraton Plaza and they were highly favorable to the new service. And what about guests in the Waldorf? No poll has been taken among them, but Waldorf management reports many compliments. At this writing, 1500 transient rooms at the Waldorf have been converted to the new service and 300 more will be added this spring.

Shortly after the Sheraton Plaza became the first all-dial hotel, Sheraton management stated: "We fully anticipate that with the success of the initial installation in the Sheraton Plaza, dial phones will

eventually be installed in all 24,000 rooms in the system . . ." Since then dial proposals have been requested for more than twenty hotels in the chain. The Hilton people are looking closely at each of their existing hotels, and have ordered dial service for their new hotels in Montreal and Pittsburgh.

An interesting facet of the Waldorf installation has been their discovery that rooms equipped with "one-digit" dialing placed 82 per cent more orders with Room Service during a recent month than rooms with manual-type telephones. Statistics like these suggest rather strongly that such new communication concepts are proving valuable both to us and the hotels.

Solving a service problem

Now JUST A BIT about a "hardware" development that is helping hotels solve a service problem that has plagued them for years: notifying guests that a message has been received for them while they were out of their room. The answer to the problem is a "message waiting light." By making a few rearrangements in the new dial light set, a special colored lamp cap is mounted in the receptacle normally provided for the dial light. When a message is received at the hotel for a guest who is out, the message center attendant operates a key and lights the lamp. When the guest returns and sees the lamp burning, he calls the hotel message operator and is given his message. Advantages: to the guest — better service; to the hotel — operating efficiencies; and to us — a customer need satisfied and a potentially important item added to our equipment line. At the Waldorf-Astoria, all 1500 transient rooms are equipped with this feature.

Motels have needs similar to those uncovered in the Hotel Studies. This summer a new 160-unit motel in Denver, Colorado, will offer its guests the advantages of "one-digit" dialing with "message waiting" sets and color telephones in all rooms. And near Richmond, Virginia, the new 6A key telephone system is now undergoing trial in an 18-unit motel. This new system permits guests to dial various locations in the motel and also to make and receive outside calls through an attendant.

Ultimate uses of the studies

PERHAPS THE BEST WAY to illustrate uses to which Industry Studies generally will be put is to discuss first the form in which the studies will reach the Associated Companies.

An important part of the Industry Study job, one that is being undertaken by the A. T. & T. Co.'s Department of Operation and Engineering, is the analysis and synthesis of separate studies, made by the Companies, into single comprehensive "Industry Digests." These "Industry Digests" will represent briefed-down versions of the larger and more detailed individual studies. Three major uses are foreseen: (1) sales training, (2) pinpointing sales opportunities, and (3) sales programming.

The sales departments, like all departments in our business, have gone through major growth in the last few years. The sales forces in the Companies have grown from 1,700 contact people in 1946 to 5,800 at the end of 1957. Combine this growth with a substantial turnover factor each year, as men move on in the business, and you face a serious problem of inexperience.

Through the "Industry Digest" we hope to hasten the period required to develop a salesman to his highest point of efficiency. The salesman who knows his customer's business best serves him best and sells most effectively and profitably. If through the "Industry Digests" we can pass along to the salesman in easy, concise, and under-

Despite the roof-top sign, this is a motel in Colorado which finds that modern telephone facilities attract and please today's travelers

standable form the "know-how" gained by the industry teams, we shall have made him a fully productive man sooner, made his customer happier, and gone a long way toward making effective use of the output of Industry Studies.

A second use for the "Industry Digest" lies in "pinpointing sales opportunities." One of the major responsibilities of sales management in any industry is "spotting" the most fertile fields in which their sales force can work. This is a continuous job in our own business. What this spotting amounts to is pooling the combined knowledge of a sales force so that each salesman profits by the experience and know-how of his fellow salesmen, blind alleys are avoided, and work is undertaken in profitable fields. The "Industry Digests" should be an effective addition to the methods now being used, since they will reflect the sales opportunities pinpointed during an intensive review of the customer's operations.

The third and perhaps major use of the Industry Digests by the Associated Companies will be in the area of sales programming. This use complements that of pinpointing sales opportunities, and expands upon it by implying that knowledge of sales opportunities is important but developing a plan of action for capitalizing on them even more important.

The sales programming job involved in capitalizing on the results of the Hotel Industry Study will be considerable – one which will involve the System sales forces over a considerable period for the immediate job, and on into the future for the important follow-up aspects of the job.

Based on the studies, it is anticipated that large hotels (500 rooms and over) will be the most fertile market for the sale of dial service. Many hotels in the medium size range (300-500 rooms) will, no doubt, also find economies and sales benefits in these new communication concepts. Larger motels, and their efforts to make their rooms attractive and up-to-date, may well contribute several hundred potential customers. All this adds up to a job of working with more than 1,100 hotel and motel customers over the next few years. Today, without any special efforts on the part of the Companies, 15 hotels and larger motels have definitely ordered dial and approximately 40 more have requested dial proposals.

In a sense, what I have described is just the immediate job that must be done. The long run follow-up job is equally important. The hotel industry has appreciated the interest we have shown in their business and the problems of communication that are involved. They have made this known to us in many ways, both through their day-to-day relations with our sales people and in their willingness to discuss with us their hopes and plans for the future. This friendly and confident attitude on their part can do a great deal to make all our jobs easier. But this same attitude also creates definite responsibilities on our part. We must, in the years to come, seek both to maintain our level of understanding of their problems (and our opportunities) and to keep our communications story ever present in their minds.

There are many avenues which we can use to maintain close touch with the industry. The first and certainly the most important are the contacts our sales people have, and will build, with hotel managements throughout the country. Perhaps equally important are the opportunities we have to work with the local, regional, and national hotel associations. These important groups can do a great deal to keep us abreast of future industry plans and current operating problems that they face.

About the future

HOTEL PEOPLE assure us that their industry will continue to undergo rapid change over the next few years. Prominent hotel men are forecasting the early use of computers as management tools in the accounting and guest service fields. They foresee new designs for hotel structures that will incorporate heliports on roofs, complex conveyor belt systems for luggage and food delivery, atomic heat and power, and other advances.

Our Industry Study teams feel that hotel communications needs too will change rapidly over the next few years. They foresee possible requirements for automatic wake-up service, maid locators and facilities for recognizing room availability, centralized recorded storage of guest messages, door answering feature incorporated in room telephones, and many other additions to the communication services utilized by hotels. Many of these communications needs will be needs the telephone companies are uniquely suited to fill; some will best be met by other suppliers; but in either event the end product of up-to-the-minute communications concepts for hotels will be the primary concern.

Other Industry Study teams are developing similar opportunities and finding challenging futures in their study areas. How well the System will capitalize on these opportunities will depend in no small part on the work of the study teams that are conducting this basic research with our business customers via the Industry Study program.

Who's Who & What's What In This Issue

(Continued from page 3)

author of our "Communications in the U.S. Satellite Program." For he was graduated in 1942 from the U.S. Merchant Marine Academy at Kings Point, N. Y., served as a ship's officer in all licensed grades aboard cargo, passenger, and troop ships, and holds a Master's License—unlimited. He returned to Kings Point in 1945 as instructor in the Department of Nautical Science and continued through various academic assignments, including assistant professor in Navigation and Astronomy and as director of the Academy planetarium. He was appointed special lecturer in 1952 at the American Museum—Hayden Planetarium in New York, where his title is now that of astronomer and he is in charge of planning, supervision, and production of programs and of navigation courses and teachers. He was leader of an American Museum—Hayden Planetarium eclipse ex-

Eldon C. Hanes

pedition to Ironwood, Michigan, in 1954, and a member of another, to Ceylon, in 1955. Meanwhile, continuing his own education, he has attained the M.S. and Ph.D. degrees in education. He has coauthored a book, written popular and scientific articles, given popular and scientific lectures to varied groups, and appeared on radio and TV. He is annual lecturer in astronomy at West Point. His present contribution is not his first connection with the Bell System; for early in 1956—again the practical application of astronomy—he was leader of a group which executed a geodetic surveying program for Western Electric to select DEW-Line sites in the Arctic.

Elizabeth Wrenshall

F. Hobart Walker was first assigned to public relations work in 1949 as editorial director for the New Jersey Company. But he had joined that company in 1927, and much of his public relations experience was gained previously when he served as commercial manager and district manager in a number of New Jersey locations. Before coming to A. T. & T. in 1954 as revenue information manager, he

had served as assistant vice president in both the Public Relations and Revenue and the Regulatory Matters Departments of New Jersey Bell. For nearly a year, during 1955-56, he assisted in direction of the Bell System Executive Conference in Asbury Park, N. J. He has held his present post in the American Company—employee information manager — since June, 1956.

ELIZABETH WRENSHALL'S ninth annual contribution on the topic of the world's telephones is noteworthy for the inclusion of authentic information about telephones in the U.S.S.R.—the first which has been available for many years to tell us how many there are. It will be apt —if repetitive—to note that she was a teacher in schools abroad before World War II and a translator for censorship authorities during that struggle, and a member of A. T. & T.'s Headquarter group since 1945. Miss Wrenshall's ability with foreign tongues is a great asset in gathering and compiling the data which she uses in her daily activities.

ELDON C. HANES joined the Indiana Bell Telephone Company in February of 1949. After a number of assignments in the Commercial Department, he was transferred to the A. T. & T. Co. in New York in July, 1953. There he joined the Long Distance and Private Line Sales group in the Commercial Division of the Department of Operation and Engineering. In the fall of 1954, he was appointed Long Distance and Private Line sales engineer and held that assignment until June of 1956. At that time, he was selected by the Alfred P. Sloan Foundation for a year's study at the Massachusetts Institute of Technology as a Sloan Fellow. Returning to the O. & E. after completion of a year's study, Mr. Hanes was appointed Industry Study engineer. In this capacity, he was responsible for System coördination of the Industry Study Program. As this MAGAZINE went to press, Mr. Hanes had been transferred to the New York Telephone Company, Long Island Area, as Division Manager, Suffolk.

HEADQUARTERS SUMMARY

Dec. 15, 1957, to March 15, 1958.

TO ESTABLISH the fundamental routing pattern of the Nation-wide Dialing Plan, each toll switching point must be ranked as a Class 1 (Regional Center), Class 2 (Sectional Center), Class 3 (Primary Center), or Class 4 (Toll Center or Toll Point) Office. Each Operating Company has completed a study to determine the most suitable office classifications and homing arrangements under this plan. Maps have been prepared which combine the results of these individual studies to show the expected 1965 switching layout for each regional area in the United States and Canada. This layout shows a total of 2182 toll offices—11 Class 1, 58 Class 2, 227 Class 3, and 1886 Class 4 offices. Sets of these maps have been sent to the Companies for use in their planning work. The maps will be reissued from time to time to reflect any changes that the Companies may make in their plans.

OPERATIONS RESEARCH—the use of scientific techniques to assist in solution of management problems—was the subject of an exploratory seminar held at 195 Broadway in February. Sponsored jointly by O. & E. and Comptroller's, the seminar was attended by about 40 representatives from nine Operating Companies, Bell Laboratories, Western Electric, Long Lines and A. T. & T. headquarters.

The program included a detailed introduction and explanation of the "OR (Operations Research) approach" to management problems presented by Dr. Philip Morse of M. I. T., Dr. Russell Ackoff of Case Institute, and Dr. George Kimball and John Magee of Arthur D. Little, Inc.

A computer demonstration, involving the solution of an inventory control problem using OR techniques, was given at the close of the first day. Talks by Bell System representatives outlined some typical current OR applications in the Bell System. These include applications in the Operating Companies, A. T. & T., Western and Bell Labs where techniques described by the guest speakers are being used to advantage.

The consensus was that OR is already being used extensively in our work of problem solving; also, that some of the newer approaches, including use of high speed computers, offer further possibilities of assistance in future management decisions.

MARK sensing of toll tickets by operators has been introduced in three offices in the System—Woonsocket, R. I., Pottstown, Pa., and the Mott Haven office in New York City.

"Mark sensing" is a method of having the operator write, in machine-readable form, the information required by Accounting to process operator-written tickets and prepare bills mechanically. The operator uses a specially designed ticket and marks with a special pencil the information to be read by the Accounting machines.

Results to date have fully met all expectations. After a further period of evaluation, it is anticipated that this method will be extended to other offices.

FOR THE THIRD late Winter and early Spring, the U. S. Air Force has made use of intercity circuits of the Long Lines Department of the A. T. and T. Co. in setting up a network to be used in experimental efforts to protect communities from tornadoes. Under the plan, weather information is gathered and processed electronically and, as a storm develops, an early warning can be given to safeguard lives and property and to divert aircraft.

The network this year comprises four circuits linking Tinker Air Force Base, near Oklahoma City, with outlying stations at Salina, Kan., Waverly, Ia., Fort Smith, Ark., and Abilene, Tex. Direction-finding devices at these stations tune in on electrical disturbances in the earth's atmosphere and speed signals simultaneously over the four circuits to Tinker Base. Here, a computer determines such facts about the disturbances as location, size, wind velocity, and forward movement. Kansas City is also connected to the network and, when the Air Force wishes to pass along storm information to its Severe Weather Warning Center there, the circuits can be linked together for voice communication.

A SUBMARINE telephone cable system between Puerto Rico and the U. S. mainland is to be constructed by the Long Lines Department of the A. T. and T. Co. and the International Telephone and Telegraph Corporation. It is expected that work on the

project will get under way this year and that service will be available early in 1960.

The cost of the cable—$17,000,000—will be shared equally by the Radio Corporation of Puerto Rico, a subsidiary of I. T. and T., and Long Lines. The over-all length of the voice link, which will extend from Puerto Rico to Florida, is about 1,100 miles. Like the other under-ocean telephone cable systems installed in the past several years, this one will consist of twin cables and handle at least 36 conversations simultaneously. A similar system between Key West and Cuba is now operated by a company jointly owned by A. T. & T. and I. T. & T.

The existing telephone service is provided by means of radio circuits, which are operating at full capacity. When the new cable system is in service, these will remain in use in order to provide diversity of routing and protection. Telephone traffic between Puerto Rico and the mainland has more than doubled in the past five years. With the new facilities, the present capacity will be doubled.

EVIDENCE of the growing importance of data processing in Bell System operations is the decision to construct an electronic data processing center for the Long Lines Department of the A. T. and T. Company at Mount Kisco, N. Y. Accounting offices at Departmental headquarters, three area headquarters and several other points will feed information into the new center, according to the plan. This center is being designed to handle data processing applications on an integrated basis, from source documents to the finished product applications planned initially. It would include studies of the use of telephone circuits, various statistical analyses, certain phases of engineering paperwork, and some accounting work. In general, the center would handle routine clerical operations.

A PRIME LETTER CONTRACT has been received from the U. S. Air Force authorizing Western Electric to design, install, and test communications equipment in connection with a Ballistic Missile Early Warning System (BMEWS). Work on the project is already under way. Western's responsibilities will involve improving and augmenting existing communication systems in Northern areas which will serve the new warning network. In addition, facilities of the commercial communications companies will be extensively employed.

The work will be handled by Western's Defense Projects Division where prior experience with the DEW Line and White Alice systems is expected to be of great value. There also will be substantial technical participation by the Bell Telephone Laboratories. Although total personnel requirements are not known now, it is expected that the present staff on the DEW Line and White Alice projects will be increased by personnel from other Bell System companies and organizations within Western Electric as the need for particular skills develops.

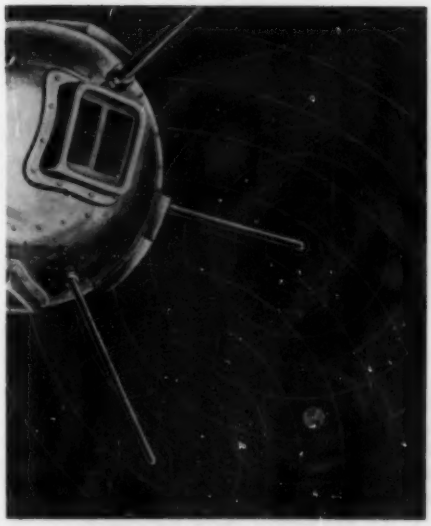
AN IMPORTANT DATE in the history of Alaska was recorded when the White Alice Network went into operation on March 26, linking citizens and military personnel of that territory through a reliable long distance telephone system. This Air Force communications system, for which Western Electric was the prime contractor, employs a new over-the-horizon radio technique to furnish telephone and telegraph facilities in an area where terrain, weather, and atmospheric conditions formerly made such facilities unreliable at best and non-existent in many cases. More than this, White Alice represents the successful completion of an Herculean task performed by 3,500 Bell System men and women in order to link Alaskans with their neighbors and provide adequate communication between U. S. air bases and radar stations in Alaska and the remote Distant Early Warning Line radar stations.

RADIO ASTRONOMY is now only a little more than twenty-five years old, and in the midst of the current international emphasis on this subject, it is of interest to trace it back to its origin—some puzzling data gathered at the Holmdel, N. J., location of Bell Laboratories. In the course of a research study into the properties of noise in radio circuits, the late Karl G. Jansky observed disturbances from a mysterious source. And a surprising fact was that this noise seemed to come from a fixed point in space. Very cautiously and methodically, Jansky proceeded to probe for an explanation until the conclusion was inescapable—the radiation was coming from the Milky Way. As a consequence, instead of being limited to the narrow range of visible light, astronomers now have "eyes" sensitive to a large portion of the radio spectrum. The Institute of Radio Engineers took note of the twenty-fifth anniversary of radio astronomy with a special January issue of the *Proceedings*, which contains a tribute to Jansky's work.

The Blue Pencil

VANGUARD'S earlier failures to perform satisfactorily at Cape Canaveral were disappointing to many—including, of course, the various people who were involved in preparation of the "satellite program" article in this issue. So when Thomas D. Nicholson received word that Vanguard and its "moon" would take off on March 17, he took off on the same day for the communications centers at Boston, Mass., and Washington, D. C., to acquire at first hand the last-minute information he needed for his contribution.

Also immediately activated—although not to the point of take-off—was Salvatore J. Taibbi, whose cover painting represents imaginatively the Vanguard satellite in orbit. His name thus moves ahead of its customary location on page one of this MAGAZINE, where it regularly appears as art editor. Mr. Taibbi joined the Public Relations Department of the A. T. & T. Co. in 1946, where he is in charge of its many and varied art activities. He won a scholarship to the School of Fine Arts in Florence, is a graduate of Pratt Institute, New York, and holds membership in the Society of Illustrators, the Art Directors Club of New York, and the National Society of Art Directors.



Cover: Vanguard satellite

BELIEF THAT experiments and tests with missiles, projectiles, and satellites are to blame for severe weather and particularly heavy storms seems to be widely held. Whether or not there is actually any connection, this past Winter and present Spring have surely handed us some beauts. Indeed, it is hard to realize that the storm of March 19-22, which brought heavy, clinging snow to the Northeastern states from Washington, D. C., to Northern Maine, caused estimated damage of more than ten million dollars; the costliest storm on record for the Bell System.

Compared with the boisterous fury of other storms, this one seemed as nothing—particularly the New England hurricane—so-called—of 1938. Come Autumn, that one will be a thing of twenty years ago—a full score of years in the past. Yet those who lived through it—who experienced its devastating, death-dealing savagery—will probably carry the recollection with them so long as they live.

There are various reasons why 1938's hurricane was so impressive. For one thing, it was the first of its kind in this area in well over a hundred years and it frightened people. In that time the population had grown and so had factories and habitations and all kinds of structures, and the damage to them and to trees and forests was vast. The death toll was in the neighborhood of 700.

This MAGAZINE had had articles descriptive of storms and storm damage and restoration as early as 1925, and has had others since 1938. But "The Bell System Meets Its Greatest Test," published in that Autumn's issue, was widely read. In 20 years no MAGAZINE reprint has equaled in quantity the reprint of that article: 350,000 copies.

And now a snowstorm outdoes the hurricane of 1938!

NO MATTER how serious the problem, how trying the situation that telephone people

face; there is always someone to provide a leaven of humor. On one of the Ohio Company trucks which proceeded eastward to the assistance of snowbound Pennsylvania an installer had inscribed the notice "Have truck—will travel."

Dreyfuss and noted Italian designers

IN THESE PAGES last Summer was voiced the conceit that this MAGAZINE "partakes somewhat, even though passively, in the growth in stature of those who contribute to it; that a bit of the lustre rubs off onto these pages when a well-known figure who has appeared therein becomes even better known."

Further evidence to the point: Henry Dreyfuss, a distinguished industrial designer, whose writings on designing the telephone appeared in our issue for Summer 1955, was honored on March 12 by members of the Bell Telephone Laboratories' Frank B. Jewett Chapter of the Telephone Pioneers of America. Though not a Bell System employee, he became the first honorary member of that Pioneer chapter.

Henry Dreyfuss has been associated with the "telephone look" for 28 years. He has collaborated with Bell Laboratories engineers in the design of many telephone instruments and related products, ranging from the "300" set to the current new small-size set for use in the home. His office today takes up a whole floor of a modern building overlooking Central Park in New York City. He also has an office in South Pasadena, California.

He now has a staff engaged in designing many household and industrial products familiar to all Americans—plumbing fixtures, appliances, radio and TV sets, machine tools, farm tractors, and lift trucks, to name a few. He also designed the passenger accommodations on the S.S. *Independence* and S.S. *Constitution*.

But Mr. Dreyfuss feels closest to the telephone industry. In addition to earlier designs, he has been responsible for the appearance of many Bell Laboratories developments in station apparatus, central office, and microwave equipment, and a wide variety of military devices.

Perhaps the most classic example to date has been the "500" set. A double honor was accorded it in Italy at the impressive Triennale di Milano—an international exhibition of industrial design, architecture, interiors, home furnishings and crafts.

The Triennial committee decided to honor two dozen internationally known designers, each of whom was given an exhibition of his own in the main building, the Palace of Art. Mr. Dreyfuss was asked to tell the story of the "500" set and such other instruments as the speakerphone, the wall set, and the six-button model.

It's Spring! Isn't that reason enough for publishing a poem—particularly a lilting, well rhymed little verse?

Of course, the verse doesn't seem to have anything to do with the telephone business. Actually, it has, though; for it was the "commercial" read on the Telephone Hour of March 31—and undoubtedly prepared by some spring-fevered versifier cooped within advertising agency walls.

Anyhow, we enjoy it—so here it is.

A TIME OF HOPE AND JOY

When the gusty winds of winter die
And the voice of spring is heard,
A man can stand on a patch of land
And capture every word.

When the birds fly north through an azure sky
And the hills are veiled in green,
A man can hear with half an ear
The sounds of the new-born scene.

For nature strums a joyous tune
On the strings of many a lyre,
And the season brings for all to hear
The songs of an April choir.

From the smell of earth that's freshly turned,
From the flashing rivers' gleam,
A man can sense the sweet presence
Of the dreamer and his dream.

For spring is a time of hope and joy
And sounds of the growing land,
And the swelling strains of a faith regained
Sing in the soul of a man.

The Bell System does a wide variety of defense work at the Government's request, and this too proceeded at many stages during 1957. In July Western Electric turned over to the United States Air Force the 3,000-mile Distant Early Warning (DEW) Line in the Arctic – completed on schedule in 32 months. The "White Alice" communication system linking population centers and military installations in Alaska will soon be in full operation. Western Electric is coördinating the work of many contractors on the SAGE air defense system and the telephone companies are furnishing circuits which interconnect radars and computers. In providing for the growth of long distance service, we are continuing to build "express" routes which by-pass areas that might be primary targets for attack; the purpose is to make increasingly sure that in event of disaster, emergency communications will be maintained.

Bell Laboratories' research and development work for the Government includes large-scale effort in developing an intercontinental ballistic missile guidance system. Western Electric has increased production of longer-range Nike missile systems which can carry nuclear warheads, and with the Laboratories is working on further improvements of the Nike missile family. The Sandia Corporation, a subsidiary of Western Electric, continues to manage the Atomic Energy Commission's Sandia Laboratory, which develops, designs and tests atomic weapons.

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